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IN THE

Supreme Court of the United States

OCTOBER TERM, 1968

NO. 949

KAISER INDUSTRIES CORPORATION, VEREINIGTE OESTERREICHISCHE EISEN-UND STAHLWERKE AKTIENGESELLSCHAFT, and BRASSERT OXYGEN TECHNIK AG., Petitioners,

v.

McLOUTH STEEL CORPORATION, Respondent.

PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE SIXTH CIRCUIT

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KAISER INDUSTRIES CORPORATION, VEREINIGTE OESTERREICHISCHE EISEN-UND STAHLWERKE AKTIENGESELLSCHAFT, and BRASSERT OXYGEN TECHNIK AG., Petitioners,

v.

McLOUTH STEEL CORPORATION, Respondent.

PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE SIXTH CIRCUIT

To The Honorable Chief Justice and the Associate Justices of the Supreme Court of the United States:

Petitioners, Kaiser Industries Corporation (Kaiser), Vereinigte Oesterreichische Eisen-und Stahlwerke Aktiengesellschaft (VOEST), and Brassert Oxygen Technik AG. (BOT), respectfully pray that a writ of certiorari issue to review the judgment of the United States Court of Appeals for the Sixth Circuit entered in this case on August 2, 1968.

Jurisdiction.

THE OPINIONS BELOW.

The opinion of the United States District Court is reported at 257 F. Supp. 372. It is printed in Appendix A to this petition at pages 45a to 204a. The opinion of the Court of Appeals for the Sixth Circuit is reported at 400 F. 2d 36. It is printed in Appendix A at pages 1a to 43a.*

JURISDICTION.

The judgment of the Court of Appeals (App. A, p. 43a) was entered on August 2, 1968. A timely petition for rehearing was filed on August 26, 1968 (the time for filing the petition having been extended by the Court). The petition for rehearing was denied on September 10, 1968 (App. A, p. 44a). The time for filing this petition was extended by this Court to January 16, 1969 by an order entered November 26, 1968. The jurisdiction of this Court is invoked pursuant to 28 U.S.C., Section 1254(1). The basis for jurisdiction in the District Court is 28 U.S.C., Section 1338 (a), and the fact that the case is an infringement action arising under the Patent Laws of the United States.

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*The Appendices to this Petition are printed separately because of the length of the Opinions below.

QUESTIONS PRESENTED.

The Suess et al. patent in issue in this action is addressed to the famous L-D or basic oxygen steelmaking process invented in Austria.

The L-D process has concededly revolutionized the steelmaking art throughout the world. In this country alone, it has saved steelmakers billions of dollars. It has rendered obsolete existing steelmaking processes. Within a reasonable period of time, as new steelmaking facilities are constructed to replace existing equipment, the L-D process will surely become the almost universally accepted method for making steel.

The District Court held that the L-D process was novel, useful and unobvious to those skilled in the art. Further, the District Court found that the gist of the invention — the avoidance of deep penetration of the oxygen jet into the molten metal bath — was adequately disclosed in the specification of the patent in suit. The District Court held, however, that the language in the claims used to define the concept of avoidance of deep penetration did not define that concept. Therefore, the District Court concluded that the patent was invalid for failure of the claims to define the invention.

In affirming the decision of the District Court, the Court of Appeals held that the language in the claims did not define the invention claimed to be patentable.

Finally, both courts invoked the file wrapper estoppel doctrine to defeat the patent in suit, although the applicability of that doctrine was never raised or briefed by respondent in either court.

Questions Presented.

The questions presented by the decisions below are as follows:

1. Did the courts below apply the proper legal standards for determining whether the claims adequately defined the invention when both courts refused to use as aids in construing the language of the claims both the file wrapper history and the specification of the patent in suit?

2. Did the courts below correctly apply the file wrapper estoppel doctrine to defeat the patent in suit when (a) there was no evidence that the applicants intended to abandon claims adequately defining their invention, (b) the file wrapper history showed affirmatively that the applicants continued to claim the real "gist" of their invention at the time the alleged abandonment took place, (c) the differences between the claims as allowed and as earlier presented consisted of mere changes of expression intended and represented to have the same meaning, and (d) the changes in words were accepted by the Patent Office as defining the real "gist" of the invention, *i.e.*, the applicants' new concept.

CONSTITUTIONAL PROVISIONS AND STATUTES INVOLVED.

The questions presented involve Article I, Section 8, Clause 8, of the Constitution, which provides that the Congress shall have power

> "To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries."

They also involve Sections 112 and 282 of the Patent Code of 1952 (35 U.S.C., §§ 112, 282), which, in pertinent part, read as follows:

Section 112:

> "The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.
>
> "The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention. * * *
>
> "An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding struc-

ture, material, or acts described in the specification and equivalents thereof."

Section 282:

"A patent shall be presumed valid. * * * The burden of establishing invalidity of a patent or any claim thereof shall rest on the party asserting it."

STATEMENT OF THE CASE.

This case involves far-reaching and significant issues affecting the steel industry in the United States and the proper construction of the patent laws of the United States, which should be considered by this Court.

The decisions below, we respectfully submit, have subverted the underlying goals and purposes of the patent laws, *i.e.*, "to bring forth new knowledge,"* by striking down a patent on a meritorious invention of great utility. The courts below acted in a fashion contrary to applicable decisions of this Court by refusing to apply liberal rules of construction to determine the meaning of language used in the claims of the patent in suit. Instead, the courts below applied rigid rules of construction which place an unfair premium on draftsmanship to the detriment of substantial rights and which turn the patent laws into a game of words.

The net effect of the decisions below has been to strike down a patent on what is concededly a revolutionary steelmaking process by strictly construing and placing an admittedly "meaningless" construction on the claims of the patent in suit and by disregarding the meaning given to the claims by the specification and file wrapper history.

This Court should review the decision of the Court of Appeals to correct the errors below and to guarantee that the patent laws will be administered in a fashion which protects, instead of defeats, valuable property rights in a significant invention of great utility.

**Graham v. John Deere Co.*, 383 U.S. 1, 9 (1966)

Statement of the Case.

A. The Nature of the Action.

This is an action charging an avowed copyist, McLouth Steel Corporation, with infringement upon the Suess et al. patent No. 2,800,631, granted July 23, 1957 (App. B, pp. 207a-212a).

Petitioner, VOEST, is a "steel company owned by the Austrian Government" (App. A, p. 3a). It is the owner of the patent. Petitioner, BOT, is a Swiss corporation, which is jointly owned by VOEST and Oesterreichisch-Alpine Montangesellschaft (OAM), another Austrian steel company which is part of Austria's nationalized industry. BOT holds exclusive worldwide licensing rights. Petitioner, Kaiser, holds exclusive licensing rights in the United States which it purchased from BOT. The respondent, McLouth, is a steelmaker having a plant at Trenton, Michigan, where it practices the L-D process taught to it by Kaiser and the Austrians.

McLouth heard of this new L-D steelmaking process and decided "to integrate the Austrian process into" its operations (App. A, p. 66a). The design of the equipment and the entire operation were "copied from the one at Linz" (App. A, p. 66a).

In the District Court, McLouth initially asserted that it had acquired a paid-up license to use the invention by reason of a technical assistance agreement it entered into with Kaiser. That issue was tried first, and both the District Court and the Court of Appeals held that McLouth did not obtain license rights under that agreement (175 F. Supp. 743; 277 F. 2d 458).

McLouth continued the battle, asserting non-infringement and invalidity. The District Court pointed out (App. A, p. 68a) that while McLouth denied "infringing the process as stated in the claims of the patent" it did "not contest the allegation that it is using the process disclosed by the specification" and used by all others. In this connection, the District Court held (App. A, p. 68a):

> "Defendant admits that the process disclosed in the specification of the Suess patent in suit is the same as the process in use at the VOEST plant in Linz, Austria. * * * Defendant further admits that the Linz process is essentially the same as the process in use at the McLouth plant * * * . * * * on final argument, counsel for defendant stated: 'We do not contest that basically, fundamentally, the Linz process, as practiced, and the McLouth process — and I may add every other oxygen blowing process of which we have any knowledge — follows the same general method.' * * * and in its reply brief, defendant stated: 'McLouth has never contested the fact that all oxygen blowing of a practical or commercial nature — and the "exemplary commercial practice" of the patent is understood to be the Linz practice — is basically similar.' "

B. The Origin and Nature of the Invention.

The L-D or basic oxygen steelmaking process disclosed in the patent has revolutionized steelmaking throughout the world, as both courts below recognized (App. A, pp. 6a-7a, 46a, 53a, 99a, 166a-167a, 202a-203a). On this point, the District Court stated (App. A, p. 46a):

"The oxygen steelmaking process at issue in this litigation has demonstrated in recent years undoubted advantages over older methods of steelmaking, including reduction of capital and operating costs, increase of production rates, and improvement in quality of the steel produced. Therefore, perfection of the process has resulted in its large-scale adoption in the United States and throughout the world. Defendant McLouth has admitted that the new oxygen steelmaking process is 'a revolutionary method of making high quality steel.' * * * Additionally, the process has been characterized by the President of Jones & Laughlin Steel Company as 'the only major technological breakthrough at the ingot level in the steel industry since before the turn of the century.' "*

In the manufacture of steel, pig iron, which is sometimes known as "hot metal" when in the liquid state, is first produced in a blast furnace. Iron ore, coke, limestone and air are the primary materials employed in making pig iron. The product of the blast furnace contains an excess of carbon, manganese, silicon, phosphorus and sulphur which must be materially reduced by a refining or steel manufacturing process in order to provide steel having satisfactory properties. This refining of the pig iron into steel has been carried out by various processes.

The Bessemer process came into being about 1856. The acid Bessemer process came first. In this process, hot metal and at times a small amount of scrap are

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*The growth and magnitude of the process are shown in PX-82, PX-83 and PX-104 (App. B, pp. 261a-270a).

charged into a converter and air or oxygen-enriched air is blown upwardly through holes in the bottom of the vessel. This was the principal refining process for many years. It was unsatisfactory for most pig irons because phosphorus and sulphur could not be removed. Also, the product was high in objectionable nitrogen. The Thomas or basic Bessemer process was devised about 1879 to permit the use of a basic slag capable of removing phosphorus by means of an afterblow. This process proved unsatisfactory because of excessive nitrogen developed in the steel (App. A, p. 5a).

The open hearth method of refining steel came into being shortly before the turn of the century and has been the principal method of refining pig iron into steel. As late as 1953, approximately 89 percent of the steel produced in the United States came from open hearth furnaces. This process produces satisfactory steel; but, as the Court of Appeals found, it "has the disadvantage of high capital and operating costs and a relatively slow rate of production" (App. A, p. 6a). The average open hearth heat requires 8 to 10 hours, as compared with approximately 40 minutes in the L-D process.

Prior to the advent of the L-D process, there were many efforts made by highly skilled men extending over decades attempting to solve the problem of how to use oxygen as the sole refining agent to make steel. All of these efforts failed to provide a commercially successful process.

Bessemer, over a hundred years ago, suggested the use of oxygen instead of air for refining pig iron into steel. Nothing came of this suggestion. In 1928, the invention of the Linde-Fraenkl process for producing

oxygen cheaply in tonnage quantities created the possibility of using pure oxygen in the commercial refining of pig iron into steel (App. A, p. 51a). In the 1930's, efforts to solve the problem of using oxygen in refining pig iron into steel were made by many highly skilled men (App. A, p. 51a). They all failed, as respondent's witness Dr. Durrer admitted (App. A, p. 51a). In the early 1940's, further efforts, including both bottom blowing and top blowing operations, were made by others (App. A, pp. 49a, 51a-52a). They failed. Dr. Durrer and Dr. Hellbruegge, in the late 1940's, tried, and they failed (App. A, pp. 23a, 51a-52a, 72a-73a, 128a-136a).

In the Bessemer process in which air is blown upwardly into the bath through the bottom and in the experimental bottom blowing and top blowing work, the fundamental concept was that it was essential to get the gas as deep into the molten metal bath as possible without injuring the refractories so as to physically agitate or stir the bath with the air or oxygen stream (App. A, pp. 50a-53a, 71a-72a, 79a-85a; App. B, pp. 219a, 230a). The best of the top blowing prior art, Schwarz and Miles, taught this; and Dr. Durrer and Dr. Hellbruegge as late as 1948-49 knew no better than to follow that concept (App. A, pp. 118a-122a). And the harder one tries to follow Miles, Schwarz and the Durrer-Hellbruegge teachings of a deeply penetrating jet to obtain agitation or stirring of the bath by the jet, the greater the failure because of refractory damage and inability to get iron oxide into the slag to create an early fluid slag capable of removing phosphorus—an absolute necessity.

The Austrian inventors were thoroughly experienced in the steel industry and knew of the work and failures of their predecessors. Nevertheless, they undertook the solution of "this great problem" of utilizing high purity oxygen for refining pig iron into steel. At the outset, they tried to follow the Durrer-Hellbruegge teachings. An accident occurred in the early stages of this work which caused extensive discussions and produced the thought that satisfactory refinement might be obtained if the impact pressure of the jet of oxygen on the molten bath was reduced so that the jet did not penetrate deeply into the bath. Controlled and comparative tests were performed which demonstrated that success was obtained only when the oxygen was blown substantially vertically downwardly onto the center of the surface of the bath so as to *avoid deep penetration* of the oxygen jet into the bath and stir or circulate the bath by *chemical reactions* instead of by the mechanical action of the jet (App. B, pp. 221a-224a, 226a-228a). Further tests were made thereafter.

Approximately 250 tests were made during this experimental and development program, after which the first commercial basic oxygen steelmaking operation in the history of the world came into being at Linz, Austria, in November, 1952.

Succinctly stated, the new concept of the patentees was that by avoiding deep penetration and the agitation of the bath caused thereby they could get the fluid slag necessary for phosphorus removal and that the circulation or stirring of the bath, which the prior workers thought had to be caused by the physical action of a deeply penetrating jet, could be obtained by chemical

reactions. They found that by utilizing a small or "intermediate" penetration, *i.e.,* sufficient penetration to avoid dangerous slopping, not so deep as to adversely affect the refractories and not so deep as to prevent iron oxide from going into the slag to provide the necessary phosphorus removal, steel of high quality could be obtained.* This is the concept which the District Court held (App. A, pp. 105a-106a, 108a-109a, 166a) to be the "gist" of the "patentable advance" made by the patentees and which they attempted to define by the claim language ["onto and below the surface * * * to an extent to avoid material agitation of the bath by the oxygen stream"] which the courts below said was "meaningless" but which the Patent Office accepted.

After these skilled Austrian steelmakers solved this "great problem," respondent's witness, Dr. Durrer, stated that their work "contradicts all metallurgical expectations" and "shows a new metallurgy with which we must first of all become acquainted" (App. A, p. 142a).

This fundamental, new concept of avoidance of deep penetration of the oxygen jet into the bath of molten metal is contrary to the teachings of the prior art that you must penetrate deeply and thereby stir or agitate the bath by the oxygen jet. It was unobvious to those skilled in the art (as the District Court held) and resulted in a completely new steelmaking process.

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*PX-332, 351F and 353 (App. B, pp. 255a-259a) show the penetration in McLouth's operations. PX-332 and PX-351F, respectively, illustrate penetration at various times in a heat, with and without consideration of the effect of slag. PX-353 is a table which covers a number of heats.

C. The Tremendous Impact of the Invention on Steelmaking Throughout the World.

The L-D process described in the patent in suit is being practiced throughout the world (App. A, pp. 6a, 46a). In the United States alone, annual L-D steelmaking capacity jumped from nothing at the beginning of 1955 to about 32 million tons by January 1, 1966 and, as of the present time, is about 56 million tons.* The annual capacity for L-D steelmaking worldwide has jumped from approximately one-half million tons in 1953 to 110 million tons in 1966, and presently is about 220 million tons. The process, throughout the world, is replacing the old processes to a phenomenal extent. No new open hearth shops have been built in this country since about 1953. More than 75 percent of all new steelmaking facilities installed throughout the world since 1954 are L-D process installations. Sixteen steel companies in the United States have adopted the process; and in other parts of the world, 64 companies in 23 countries have installed the new process (App. A, pp. 6a-7a, 53a, 99a; App. B, pp. 265a-270a).

In the United States, licenses have been granted to a number of substantial producers, *i.e.*, Acme (Interlake), Armco, Kaiser Steel, Allegheny Ludlum, J. & L. and Alan Wood (App. A, p. 53a). Throughout the world, there are 76 companies in 20 countries which have been licensed to use the process.

The advantages and accomplishments of the invention are tremendous. The capital cost for a ton of annual capacity for the oxygen steelmaking process is

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*Total annual production in the United States by all processes is approximately 130 million tons.

about $15, as compared with about $40 per ton for open hearth capacity. The savings in operating costs are equally substantial, amounting to between $4 and $5 per ton. Thus, U. S. steelmakers, as of 1966, were saving over $100 million *annually* in operating costs and as of today this figure is approximately $250 million.

The increase in speed of operation is likewise striking. The whole oxygen steelmaking process takes about 40 minutes as compared with approximately 8 to 10 hours in an open hearth (App. A, p. 50a).

In the light of such facts, the courts below should have accorded the patent in suit the liberal treatment and construction to which it is entitled under the decisions of this Court.

D. The History of the Patent Applications.

The original application, filed January 16, 1951, contained clear teachings that the blowing was to be done in a manner to avoid deep penetration of the jet into the molten metal bath and to circulate the bath by the chemical reactions. That application was supplanted by a continuation-in-part application filed November 16, 1955 which eventuated into the patent in suit. This application, as the District Court held, fully discloses and teaches the new concept of the patentees (App. A, pp. 54a-63a, 78a, 100a-106a). It was claimed explicitly in the original claims. It was included in amended claims. And, as the file wrapper history (including the Rinesch and Hauttmann affidavits) shows, the new concept — the gist of the invention — was constantly asserted and never abandoned (App. B, pp. 219a-

230a). When the claims were rewritten in the amendment (App. B, pp. 214a-218a) which ultimately resulted in the allowance of the patent, the same fundamentally new concept was embodied therein. Different words were used to define that concept, but the affidavits filed at that time (App. B, pp. 219a-230a) make it crystal clear that the applicants were asserting the same new concept as that described in the specification.

The main claim of the patent in suit* states that a stream of oxygen is discharged "vertically downwardly through the slag layer onto and below the surface of the bath at the central portion thereof, *to an extent* [*i.e.*, to a depth] to avoid material agitation of the bath by the oxygen stream."** The claim further points out that the stirring or circulation of the bath is brought about by the chemical reactions as distinguished from the physical action of a deeply penetrating jet. Thus, the claim, as the file wrapper history shows so clearly, says to blow so as to avoid deep penetration of the oxygen stream into the bath. The file wrapper history, and specifically the Rinesch and Hauttmann affidavits (App. B, pp. 218a-229a), which the courts below refused to consider on this point, demonstrates that it was this concept the patentees represented to the Patent Office to be their invention, and that this is what both the Patent Office and the patentees thought was defined by the words used in the claim.

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*A copy of the patent is reproduced in Appendix B, at pages 207a-212a. Claim 1, the principal claim, is reproduced separately in Appendix B at page 213a.

**Emphasis ours except where noted otherwise.

E. The Holdings of the Courts Below.

The District Court, after listening to and analyzing all the evidence, came to the conclusion that the patentees had a meritorious invention. In this regard, the District Court stated it was "convinced * * * that the 'new mental concept' of the patentees to avoid a deep penetration of the bath by the jet was a patentable advance in the art of steelmaking," and held (1) that this "patentable advance" was not anticipated by any of the prior art, (2) that the invention was not obvious to those skilled in the art, (3) that the invention has great utility, and (4) that the invention was fully and adequately set forth in the specification so that those skilled in the art could practice it (App. A, pp. 166a-167a, 78a-79a, 80a-83a, 85a, 89a, 107a-116a, 46a, 150a, 153a-154a, 158a). However, it construed the claims as "meaningless" and "fictional" (App. A, p. 178a) and held the patent invalid for failure of the claims to comply with 35 U.S.C., Section 112. It held that the *gist* of the invention *as described in the specification and file wrapper history* was not in the claims and could not be read into the claims and that its omission caused the claims to overclaim the invention and read on the prior art. It also held, *sua sponte,* that the doctrine of file wrapper estoppel precluded construing the claims to embrace the gist of the invention. In construing the claims, it disregarded the fact that the specification and file history, as the court found, tell exactly what the invention is.

Significantly, the District Court concluded by saying (App. A, p. 202a):

> "The Court reaches its conclusion that the patent in suit is invalid reluctantly, not only be-

cause of the statutory presumption of validity but also because of the revolutionary nature of the invention disclosed in the specification. Revolutionary patents such as this one are entitled to a liberal construction."

The Court of Appeals affirmed the District Court's holding of invalidity on the grounds stated above. It also stated that it had doubts about the District Court's finding of non-obviousness, improperly relying on "subjective notions," * which were contrary to express findings of the lower court, and rejecting all objective criteria in an attempt (App. A, pp. 3a, 7a) to justify its narrow and unrealistic construction of the patent. It did not modify the District Court's finding of unobviousness; but, in its discussion, it destroyed the statutory presumption of validity on the *amazing* ground that the Schwarz patent "was not considered by the Patent Office" (App. A, p. 13a); whereas, the facts are, as shown by the file wrapper history, that it was called to the attention of the Examiner, a written argument against it was submitted, and it was referred to and distinguished in the two affidavits which brought about allowance of the patent (App. B, pp. 214a-218a, 219a-225a, 226a-230a).

The net effect of the decisions below was to deny the patent in suit the "liberal construction" mentioned by the District Court (*supra,* pp. 18-19). What the courts below did was to apply rigid standards for determining whether the *claims* described the invention, instead of using liberal standards and taking into account

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**In re Cable,* 347 F. 2d 872, 878 (CCPA 1965); *Allen v. Standard Crankshaft & Hydraulic Co.,* 323 F. 2d 29, 34 (4th Cir. 1963).

the file wrapper history and the specification as aids in construing the language in the claims.

The end result of the decisions below was to turn the patent laws into a game of words or a "game of skill in which one misstep by counsel may be decisive to the outcome": *Conley v. Gibson,* 355 U.S. 41, 48 (1957).

ARGUMENT AND REASONS FOR GRANTING THE WRIT.

I. The Lower Courts' Construction of the Claims Is Contrary to Established Standards and Grossly Unfair.

It seems clear that the errors of the courts below resulted from the application of erroneous standards for construing the language used in the claims. Both courts failed to accord the patent the liberal treatment to which it is entitled as a result of the magnitude of the patentees' contribution to the useful arts. Both courts *refused* to look to the file wrapper history in conjunction with the specification to aid in construing the language in the claims.

The decisions below raise substantial problems for the administration of the patent laws by placing an extremely high premium on draftsmanship. In effect, a patentee will be deprived of the fruits of his invention if the words he uses to claim his invention depart from the rigid standards of draftsmanship required by the decisions below, even though the entire history of the patent application clarifies any language deficiencies existing in the claims.

This, we submit, is a problem worthy of review by this Court, particularly in the circumstances of this case when rigid standards have been used to deprive the patentees of their rights in an invention of great significance and utility, *i.e.,* one which has saved steelmakers and the public billions of dollars.

The decisions below make a sham of the patent laws. If they represent the public policy of the United

States, no one bringing into being a basic invention, whether from the United States or from a foreign land, would dare to face the semantic snare of our patent laws with any hope of fair treatment.

Even as to a meritorious improvement invention, this Court, in *Eibel Process Company v. Minnesota & Ontario Paper Company,* 261 U.S. 45 (1923), stated (p. 63) that it

> "* * * certainly finds no reason to withhold from the really meritorious improver, the application of the rule 'ut res magis valeat quam pereat,' which has been sustained in so many cases in this Court. *Winans v. Denmead,* 15 How. 338, 341; *Corning v. Burden,* 15 How. 265, 269; *Turrill v. Railroad Co.,* 1 Wall. 491, 510; *Rubber Co. v. Goodyear,* 9 Wall. 788, 795; *McClain v. Ortmayer,* 141 U.S. 419, 425."

In the *Eibel* case, this Court also stated (p. 63):

> "In administering the patent law the court first looks into the art to find what the real merit of the alleged discovery or invention is and whether it has advanced the art substantially. If it has done so, then the court is liberal in its construction of the patent to secure to the inventor the reward he deserves."

Instead of determining from the file wrapper history and the specification the true meaning of the expressions used in the claims and applying that construction, the courts below expressly refused to follow the rule stated by this Court in *Graham v. John Deere Co.,* 383 U.S. 1, 33 (1966) that "an invention is construed

not only in the light of the claims, but also with reference to the file wrapper or prosecution history in the Patent Office."

The District Court held (1) that the "specification * * * teaches the avoidance of deep penetration as an essential characteristic of the process of the patent," (2) that it is clear from the claims that "the language concerning avoidance of material agitation must be read with reference to penetration by the jet * * *," and (3) that the Rinesch and Hauttmann affidavits attributed a "causal connection between the avoidance of deep penetration and the existence of the features of the patent claims," including avoidance of material agitation of the bath, circulation created by chemical reactions and the localized reaction zone (App. A, pp. 78a, 105a-106a, 109a, 153a-154a, 160a, 172a). However, that court *refused* to look to the file wrapper or prosecution history in interpreting the claims, stating that one reading the patent would not be "responsible for knowing the contents of" the affidavits in the file wrapper history (App. A, pp. 176a-177a). The Court of Appeals (App. A, p. 30a) also refused to consider what it termed "affidavits submitted to the Patent Office and filed somewhere obscurely in the file wrapper history of the patent."* The Court of Appeals even said that the patent

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*As this Court knows, affidavits, and particularly affidavits which lead to the issuance of a patent, are not filed "obscurely" in the file wrapper history. The file wrapper history, which is open to the public the day the patent issues, always is referred to by anyone attempting to understand and construe the difficult language of claims.

law "does not require a prospective inventor to search so far in attempting to determine the scope of a patent and the areas left open for inventive inquiry" (App. A, p. 30a). But the law does require anyone attempting to construe and determine the scope of a patent to look to the file wrapper history, as this Court has repeatedly held.

Obviously, the important limitation in the claims of "discharging a stream of oxygen vertically downwardly * * * onto and below the surface of the bath at the central portion thereof, to an *extent* [depth] to avoid material agitation of the bath by the oxygen stream" cannot be "meaningless." It meant something to the applicants and it meant something to the Patent Office. Both were making an effort to define the invention fully and adequately (App. A, p. 158a) set forth in the specification and discussed in detail in the Hauttmann and Rinesch affidavits (App. B, pp. 219a-230a) which led to the issuance of the patent. For example, Dr. Hauttmann, in the summary paragraph of his affidavit, stated (App. B, p. 230a):

> "Inasmuch as our concept of securing purification of the entire contents of the bath mainly by the controlled circulation induced by the reaction center is just the opposite of trying to carry the oxygen to all parts of the bath by agitation produced by deep penetration, as by the methods disclosed in the Schwarz and Miles patents, and constitutes a major technical advance in the commercial manufacture of steel from crude iron, I believe that our method is patentable."

The language of the revised claim takes on a clear and definite meaning when read in the light of such language in the affidavit. When so read, avoidance of material agitation by the oxygen stream referred to in the revised claim *must* mean avoidance of the "agitation produced by deep penetration" referred to in the contemporaneous affidavit. If agitation produced by deep penetration is to be avoided, it is implicit that the cause of such agitation (deep penetration) is to be avoided. The language of the claim when so construed, therefore, clearly describes the concept of avoiding the deep penetration taught by the prior art.

The refusal of the court below to look at the exact documents which resulted in issuance of the patent and which show the meaning which both the patentees and the Patent Office attributed to the claim language is contrary to the law and grossly inequitable.*

As stated, *supra,* pages 18-19, the primary basis for the decisions of the courts below was that the claims of the patent were not sufficiently precise to meet the requirements of 35 U.S.C., § 112. In analyzing the claims and specification of the patent under §112, the courts below ignored the substance of the patent and instead, in a manner reminiscent of Baron Parke construing common law pleadings, examined in minute detail and

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*As Mr. Justice Holmes said in *Towne v. Eisner,* 245 U.S. 418, 425 (1918):

> "A word is not a crystal, transparent and unchanged, it is the skin of a living thought and may vary greatly in color and content according to the circumstances and the time in which it is used."

dissected in a hypertechnical manner the terms used in the patent claims.* The Court of Appeals' construction of § 112 is inconsistent with the primary purpose of the patent laws—to provide protection for true inventions; inconsistent with decisions in other circuits; and inconsistent with established rules of patent construction.

Courts have frequently recognized that a hypertechnical and strict construction of § 112 may deny to inventors the protection the patent laws were designed to grant. In drafting patent claims inventors are frequently compelled to use language which is inherently imprecise. Claims, unlike algebraic equations, are not always susceptible to mathematical precision. Consequently, courts have been vigilant to protect against hypertechnical constructions of § 112 which frustrate the operation of the patent laws: *e.g., Georgia-Pacific Corp. v. United States Plywood Corp.,* 258 F. 2d 124, 136 (2d Cir. 1958), cert. denied 358 U.S. 884; *Jones Knitting Corp. v. Morgan,* 361 F. 2d 451 (3rd Cir. 1966). This has been particularly true with respect to pioneer patents, such as the one in this case: *e.g., Corning Glass v. Anchor Hocking Glass Corp.,* 374 F. 2d 473 (3rd Cir. 1967), cert. denied 389 U.S. 826.

Generally the courts in construing the claims have examined not only the particular terms used in the claims, but have examined these in light of the entire patent and the prosecution history in the Patent

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*It was said of Baron Parke, "His fault was an almost superstitious reverance for the dark technicalities of special pleading, and the reforms introduced by the Common Law Procedure Acts of 1854 and 1855 occasioned his resignation." Sir James Parke, 15 D.N.B. 226.

Office: *e.g., Criner v. Micro-Westco, Inc.,* 139 F.2d 681 (8th Cir. 1944). Moreover, since there is frequently a problem of achieving precision in the language of claims, the courts have established the doctrine that a patentee may define the terms he uses and that definition will govern. The patentee can be his own lexicographer. This is particularly true where the terms defined by the patentee are unusual or uncommon: *e.g., Stuart Oxygen Co. v. Josephian,* 162 F. 2d 857, 860-61 (9th Cir. 1947); *Universal Oil Products Co. v. Globe Oil & Refining Co.,* 137 F. 2d 3, 6 (7th Cir. 1943), aff'd. 322 U.S. 471 (1944); *Technograph Printed Circuits Ltd. et al. v. Bendix Aviation Corp.,* 218 F. Supp. 1, 38 (D. Md. 1963), aff'd. 327 F. 2d 497 (4th Cir. 1964), cert. denied 379 U. S. 826.

For instance, in *Application of Corr,* 347 F. 2d 578 (CCPA, 1965), the Court of Customs and Patent Appeals reversed a decision of the Patent Office Board of Appeals which had rejected the claims of a patent application as unlawfully broad and indefinite. The court stated that if the claims were read without reference to additional materials, they would in fact be unduly broad. However, the terms used in the claims were adequately defined in the specification and this definition was sufficient to dispel any uncertainty or overbreadth. The court acknowledged that the patentee could "be his own lexicographer" (347 F. 2d at 580).

This well-established rule of construction was undoubtedly known to the patentees in this case. Prior to the issuance of the patent, they supplied affidavits defining the terms in the claims and relating them to the

specification.* Contrary to the above cases, the Court of Appeals in this case refused to accept the patentees' definitions of the terms used in the claims as set forth in the affidavits. It refused to allow the patentees to define their own terms.

By refusing to accept the patentees' definition of the terms of the claims, the Court of Appeals upset the patentees' justified reliance on a well-established rule of construction. In addition, it cast grave doubt on the validity of numerous other patents drafted in reliance on that doctrine. It interpreted § 112 in a hypertechnical manner that is contrary to the primary purpose of the patent laws.

This Court should review and reverse the decision below in order to resolve the conflict between that decision, this Court's decision in the *Graham* case, *supra,* and those cases cited above and to dispel the doubt cast on other valid patents by this erroneous interpretation of §112.

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*The fact that the definition of the terms in the claims was contained in affidavits filed with the Patent Office rather than in the patent itself is of no significance. The primary purpose of §112 is to require claims sufficiently definite (1) to apprise others of what is claimed by the patent and (2) to prevent patentees from extending their monopoly to cover more than what is set forth in the specification of the patent. Each of those purposes is served as well by definitions supplied by affidavits as by definitions contained in the patent itself. The affidavits were available for anyone to examine and thus could adequately apprise others of precisely what was claimed by the patentees. In addition, the definitions could properly be invoked to limit the patentees' monopoly to precisely the invention covered by the specification.

II. The Courts Below Misconstrued and Misapplied the File Wrapper Estoppel Doctrine.

Both courts below (Judge Edwards dissenting in the Court of Appeals) invoked the doctrine of file wrapper estoppel against petitioners with the result that patent rights on a meritorious invention were declared forfeited. This result was reached in spite of the facts that there was no evidence of an intent to abandon claims defining the invention and that respondent did not assert file wrapper estoppel in the District Court, did not argue the matter in the Court of Appeals and did not at any time attempt to support the applicability of this doctrine.

How can there possibly be a file wrapper estoppel against the correct and only meaningful construction of the claims when, at the very time those claims were presented to the Patent Office, the applicants, in affidavits (App. B, pp. 219a-230a), repeatedly and forcefully pointed out that they were seeking protection on the concept of avoidance of deep penetration in the claims presented? As the District Court found, those affidavits, in fact, "attributed a causal connection between the avoidance of deep penetration and the existence of the features of the patent claims, including a localized reaction zone, the avoidance of material agitation of the bath and a circulation caused by chemical reactions" (App. A, p. 109a).

How can there be an abandonment of the concept of avoidance of deep penetration when, at the very instant the abandonment inferred by the court below allegedly took place, the applicants repeatedly said that the important feature of their new process was the

avoidance of deep penetration of the oxygen jet into the bath?

The courts below misconstrued and misapplied this oft-applied and little understood doctrine as enounced by this Court in *Smith v. Magic City Kennel Club, Inc. et al.,* 282 U.S. 784, 789-90 (1931); *Schriber-Schroth Co. v. Cleveland Trust Co. et al.,* 311 U.S. 211 (1940); *Hubbell v. United States,* 179 U.S. 77, 80, 83 (1900); and other cases cited therein. In view of the forfeiture of valuable rights under the decisions below, this Court should now make clear the scope of this doctrine.

The court below based its holding of file wrapper estoppel on abandonment of specific words, stating that the defense is established "if a phrase used in an abandoned or rejected claim is not used in a later accepted claim" (App. A, p. 40a). This is directly contrary to *Hubbell v. United States, supra,* which states that

> "* * * where the differences between the claim as made and as allowed consist of mere changes of expression, having substantially the same meaning, such changes, made to meet the views of the examiners, ought not to be permitted to defeat a meritorious claimant. While not allowed to revive a rejected claim, by a broad construction of the claim allowed, yet the patentee is entitled to a fair construction of the terms of his claim as actually granted."

The holding of the courts below would preclude rewriting of claims to better define an invention — a practice which is as old as the patent system. If one cannot change words to better define an invention and *at the same time* repeatedly say that the same concept is being redefined, under what circumstances could anyone even dare to change words? Clearly, estoppel requires abandonment of a feature, thought or concept, *i.e.*, something of substance, not mere abandonment of words.

CONCLUSION.

We earnestly submit that this petition should be granted for each of the following reasons:

1. The case is of great importance to the Austrian Government, the Austrian steel industry, BOT, Kaiser and the steel industry both here and abroad.

2. The decisions below violate principles established by this Court's prior decisions and is in conflict with decisions of other Courts of Appeals.

3. The decisions below misinterpret and misapply the file wrapper estoppel doctrine as enounced in the prior decisions of this Court.

4. The decisions below effectively make a sham of our Patent Laws and the constitutional provision on which they are based.

Respectfully submitted,

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IN THE

Supreme Court of the United States

OCTOBER TERM, 1968

NO. 949

KAISER INDUSTRIES CORPORATION, VEREINIGTE OESTERREICHISCHE EISEN-UND STAHLWERKE AKTIENGESELLSCHAFT, and BRASSERT OXYGEN TECHNIK AG., Petitioners,

v.

McLOUTH STEEL CORPORATION, Respondent.

APPENDICES TO PETITION FOR WRIT OF CERTIORARI

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APPENDIX A

OPINIONS, JUDGMENTS AND ORDER BELOW

Opinion of the Court of Appeals

[Decided August 2, 1968]

Before: WEICK, Chief Judge, EDWARDS and CELEBREZZE, Circuit Judges.

CELEBREZZE, Circuit Judge. Appellants filed an action in the United States District Court for the Eastern District of Michigan complaining that Appellee had infringed the Appellants' patented process for refining steel with pure oxygen. Appellee first defended by contending that a know-how agreement, for which Appellee paid $100,000 to Appellants, constituted a license to use the Appellants' process. The District Court held against the Appellee on that point, *Henry J. Kaiser Company v. McLouth Steel Corporation,* 175 F.Supp. 743 D.C. Mich. 1959), and in an interlocutory appeal was affirmed by this Court. *McLouth Steel Corporation v. Henry J. Kaiser Company,* 277 F.2d 458 (6th Cir. 1960). These rulings made it possible for the Appellee to contest the validity of the Appellants' patent at the trial on infringement[1]. The handling of the protracted trial on infringement by the District Judge was a monumental task, which he performed ably and well. After unusually long and complex litigation, involving several years of pretrial research, experimentation and discovery and over an entire calendar year of trial, the District Court concluded that the patentees were the

1. Only in exceptional circumstances can a licensee contest the validity of the patent that he is licensed to use. *Cf. Sola Electric Co. v. Jefferson Electric Co.,* 317 U.S. 173 (1942).

inventors of a process that was not anticipated by the prior art and would not have been obvious to one skilled in the art at the time of the discovery. The Court held the patent invalid, however, for the reason that the specifications did not support the claims and the claims did not measure the invention as required by 35 U.S.C. § 112 and for the further reason that the claims covered the prior art.[1a] *Kaiser v. McLouth,* 257 F.Supp. 372 (D.C. Mich. 1966). From that judgment the Appellants have perfected the instant appeal contesting the Court's rulings covering the claims and specifications; and in addition the Appellee has contested the District Court's holdings on obviousness and inventorship.

In reaching its decision, the District Court wrote a long and comprehensive decision ruling on the issues of anticipation, obviousness, inventorship, compliance of the specifications with Section 112, and compliance of the claims with Section 112. In addition the District Court ruled that the doctrine of file wrapper estoppel applied to prevent the Appellants from claiming the advance that they now allege is the gist of their invention. Since we conclude that the claims overclaim the invention as represented to the Patent Office by the patentees and that the claims cover the prior art, we

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1a. The apparent inconsistency of the District Court's holding that the invention was nonobvious and the holding that the claims cover the prior art results from the manner in which the Court decided the question of obviousness. In fact, the holdings are not necessarily inconsistent since a patentee can disclose a nonobvious invention in his specifications yet claim too broadly, covering not only what is new but also what is old in the art. *Holstensson v. V-M Corp.,* 325 F.2d 109 (6th Cir. 1963).

find it unnecessary to consider the correctness of every ruling of the District Court. On the other hand, a consideration of the factual background of this case and of the errors we find in the District Court's ruling on obviousness will aid in understanding the reasoning by which this Court has reached its decision.

Plaintiffs-Appellants in this action are the owner, the exclusive world-wide licensing firm, and the exclusive licensing agent in the United States of the patent in suit. Vereinigte Oesterreichische Eisen-Und Stahlwerke Aktiengesellschaft (hereinafter VOEST), a steel company owned by the Austrian Government, is the present owner of the patent in suit by virtue of assignment from the patentees, who at the time of the experimentation that led to the application for the patent in suit were employees of VOEST. Brassert Oxygen Technik AG. (hereinafter BOT), a Swiss corporation, was formed in the early 1950's by VOEST and several other European steel companies as the exclusive world-wide licensing agent for a pool of patent rights relating to the use of oxygen in steelmaking, which included the patent in suit after its issuance in 1957. In May of 1954 BOT and the Henry J. Kaiser Company (hereinafter Kaiser), a Nevada corporation, entered into an agreement by which Kaiser became the exclusive licensing agent for BOT in the United States and thus entitled to sue for infringement of the patent in suit when it became a part of the BOT pool of patents.

Appellee McLouth Steel Corporation (hereinafter McLouth), is a Michigan corporation having a steel plant located in Trenton, Michigan, whose operations are alleged to infringe the patent in suit.

In this action McLouth is accused of infringing Patent No. 2,800,631 (hereinafter the Suess Patent), which was issued July 23, 1957, to four Austrian steelmakers, Drs. Theodor Edward Suess, Herbert Trenkler, Hubert Hauttmann and Rudolf Rinesch on the basis of a process developed at Linz, Austria, in 1949, (hereinafter the L-D Process). Only two prior art patents are relied upon by McLouth in this appeal: The Schwarz German Patent No. 735,196 dated July 3, 1943 (hereinafter the Schwarz Patent); and the Miles Belgian Patent No. 486,316 dated March 1, 1947 (hereinafter the Miles Patent). In addition, McLouth relies upon experimentation by Dr. Robert Durrer and Dr. Heinrich Hellbruegge, (hereinafter the Gerlafingen experiment) which was conducted in Gerlafingen, Switzerland, in 1948 and the spring of 1949 and the results of which were fully disclosed to the patentees, as proving non-inventorship.

Producing steel from iron ore involves at least two processes. Iron ore, which exists in nature in the form of oxides of iron, is first processed through a blast furnace where the oxygen is removed from the iron ore. This process reduces the iron oxide to relatively pure iron, but it does not remove the other impurities present in the iron ore. In fact, the blast furnace process increases the carbon content of the resultant product, which is known as pig iron. To produce steel from the pig iron, the amounts of these impurities, carbon, silicon, phosphorous, maganese, and sulphur, must be reduced to an acceptable level without adding any significant amount of oxygen or nitrogen. Accomplishing this result is the purpose of the second process involved in steelmaking: the refining process.

The patents involved in this suit are concerned exclusively with the refining process, which involves essentially oxidizing the impurities and removing them from the molten pig iron. Carbon combines with oxygen to form carbon monoxide or carbon dioxide and is exhausted as a gas. Silicon, phosphorous, sulphur, and manganese form various oxides and are absorbed into a slag layer that is formed on top of the metal bath by the addition of lime and other materials before and during the operation. Since the various impurities react with oxygen at different rates, the problem of steelmaking is to control the refining process so that sufficient amounts of all the impurities are removed.

Various methods have been devised to accomplish this refining process. The oldest method is the acid Bessemer process, which was developed in the 1850's and involves blowing air into a molten bath of pig iron from below through tuyeres in the bottom of a converter. This process was unsatisfactory for most pig iron, however, because a basic slag for phosphorous removal could not be formed in the converter, which had an acid refractory lining. As a result, only pig iron with an already sufficiently low phosphorous content could be satisfactorily refined by this method.

The Thomas process, or basic Bessemer process, was devised during 1879 to permit the use of a basic slag capable of removing phorphorous and sulphur. This process also proved unsatisfactory: because air was blown, an excessive nitrogen content developed in the steel produced, and because the blowing was from below, insufficient iron oxide was formed in the slag for phorphorous removal, thus requiring an afterblow for adequate removal of phosphorous.

Although the electric furnace has recently been used for refining, the high cost of the operation has limited its usefulness to the making of specialty steels. Therefore, since the 1880's the principal method of refining steel has been the open hearth process. As late as 1953, approximately eighty-nine per cent of the steel produced in the United States came from open hearth furnaces, which produce steel of excellent quality. The process, however, has the disadvantage of high capital and operating costs and a relatively slow rate of production. An average open hearth heat requires eight to ten hours, while a blow in a Thomas operation requires only approximately eighteen minutes.[2]

The basic process combines the best qualities of the Thomas and the open hearth processes: it produces a steel of excellent quality in a relatively short blowing period; and it has low capital and operating costs. Since VOEST began the first commercial operation of the basic oxygen process at Linz in November, 1952, the process has had a considerable impact on the steelmaking industry. According to the Appellants, more than seventy-five per cent of all new steelmaking facilities constructed since 1954, or now in the planning stage, use the basic oxygen process. Sixteen companies in the United States have begun or planned oxygen blowing facilities, and sixty-four companies in twenty-three countries have installed, or are installing, the new process. The process has demonstrated undoubted advantages over previous methods of refining steel. Its use has resulted in substantial savings to those com-

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2. For a more comprehensive discussion of steelmaking and the history of its development see the District Court's Opinion, 257 F. Supp. at 378-9.

panies now employing the process; and its use in the future will undoubtedly result in substantial savings and improved production for the steel industry as a whole.

McLouth is admittedly using the basic oxygen process. When in 1953 McLouth decided to expand its operations, it learned of the basic oxygen process being used at Linz and sent one of its officers to Linz to observe the operations. Further information about the process was obtained from Kaiser, and in 1954 Kaiser agreed to furnish know-how, engineering knowledge, and consultation services to McLouth at a cost of $100,000. With this assistance McLouth constructed its OP-1 steelmaking shop, the design of the operation being copied from the one at Linz. Although McLouth interpreted the know-how agreement as a license to use the basic oxygen process, Kaiser brought suit for patent infringement. When the Suess Patent was finally granted, the complaint was amended to allege infringement of that patent.

In the District Court, McLouth raised virtually all of the standard defenses in a patent case from invalidity and non-infringement to patent misuse.[3] Although the District Court's judgment for McLouth was based on the Section 112 defenses and although our affirmance is based on the same defense, a discussion of the District Court's treatment of the defense of obviousness will better provide the necessary background. The primary thrust of McLouth's defense appears to be this: when properly practiced the process taught in the prior art Schwarz and Miles Patents produces the same results

3. 257 F. Supp. at 386.

in the same way as the L-D Process disclosed in the specifications of the Suess Patent. In asserting the defense McLouth evidenced some confusion as to whether this contention should be raised under the defense of anticipation or under the defense of obviousness; and McLouth's ambivalence concerning the proper defense seems to have contributed to the District Court's failure to make certain essential findings of fact on the issue of obviousness. We share some of the Appellee's perplexity concerning the proper defense,[4] but in view of the disposition made of the case find it unnecessary to resolve that issue.

Appellants contend that ". . . it lies ill in the mouth of this copyist to assert . . . invalidity . . ." But when the defense is that the advance claimed by the patentees would have been obvious to one skilled in the art, more is involved than a weighing of the equities between the parties. The question becomes one of the public policy in granting patent monopolies and of applying the constitutional and statutory standards requisite to such a grant. *Graham v. John Deere Co.*, 383 U.S. 1 (1966).

In essence McLouth contends that the Linz experiments were nothing more than the development of know-how and engineering knowledge to facilitate the establishmen' of the first commercial basic oxygen process. If this contention is true, the Appellants had nothing to sell but know-how, which they sold to Mc-

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4. In *Graham v. John Deere Co.*, 383 U.S. 1, 10-2 (1966), the United States Supreme Court noted the confusion that resulted from the early development of the term "invention" as a word of legal art. Although *Graham* went far towards clearing up the confusion, certain areas still remain perplexing.

Louth for $100,000. To counter this contention, the Appellants contend that the patentee's new concept ". . . was the direct antithesis of the thinking then prevalent in the steelmaking art." This penchant of the patentees for creating a verbal antithesis to distinguish every patent that might serve as an interference reference has raised other problems of divining exactly what novel element the patentees claim and how that novel element might be meaningfully distinguished from the prior art. Appellants say that the Suess Patent teaches "avoidance of deep penetration", where the Schwarz and Miles Patents taught "deep penetration". But "avoidance of deep penetration" as an abstract phrase means no more to one skilled in the art than does "deep penetration". Depth of penetration can gain meaning only from the limitations placed upon it by the patents and from the knowledge that may be attributed to an ordinary worker skilled in the art.

The nature of McLouth's defense compels the Court to attempt to distinguish inventive experimentation from mere development of know-how in an art with which the Court has no familiarity. The ultimate distinction is one of law because it amounts to a determination of obviousness or non-obviousness. *A. & P. Tea Co. v. Supermarket Corp.*, 340 U.S. 147 (1950). Several basic factual inquiries are essential, however, to establish a foundation upon which the legal conclusion can be based. The scope and content of the prior art must be determined; the differences between the prior art and the claims at issue must be ascertained; and the level of ordinary skill in the pertinent art must be resolved. *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1963).

In the *Graham* case the United States Supreme Court noted that secondary considerations, such as longfelt but unsolved needs, commercial success, and the like, might have some relevance on the issue of obviousness. 383 U.S. at 17-18. But the Court's further analysis of the Scoggins Patent, 383 U.S. at 26-36, shows clearly that these considerations are truly secondary and will not serve as a substitute for more direct evidence of obviousness. The difficulty we find with the District Court's conclusion of nonobviousness is that the conclusion is based entirely upon these secondary considerations.[5] We do not have the benefit of a complete determination of the difference between the prior

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5. The District Court did not extensively analyze the prior art patents in the section of the Opinion concerned with obviousness. The most extensive analysis of the prior art patents was made in the section of the Opinion concerned with the defense of anticipation, 257 F. Supp. at 387-395, where the test applied was that the disclosures of the prior patents must be so full and complete as to require *no* further experimentation. Whatever the proper test for anticipation may be, that is not the test for obviousness, where the inquiry is whether the experimentation involved was within the ingenuity of a workman having ordinary skills in the art. *Reiner v. I. Leon Co., Inc.*, 285 F.2d 501 (2d Cir. 1960). Because of the stringent test applied, the findings of the District Court in the section concerning anticipation cannot be applied to a determination of obviousness without some qualifications. The same qualifications must be applied to the findings in the section of the Opinion concerned with inventorship, 257 F. Supp. at 406-419, where the same stringent test of "*no* further experimentation" was employed. Since the District Court did not rely upon these findings in concluding that the patentees' invention was nonobvious, we consider them applicable only after a proper evaluation with the test of obviousness in mind.

art and the patent in suit or of any findings concerning the level of skill in the pertinent art.

In determining the prior art a court must consider only the art prior to the date of invention and not read into the prior art knowledge obtained from later disclosures. A foreign inventor, however, cannot establish a date of invention earlier than his first filing date in a foreign country, when that date is earlier than his first filing date in this country. 35 U.S.C. §§ 104 and 119. Patentees filed their first application for a patent on the L-D Process in Austria on January 31, 1950; so that is the earliest termination date for consideration of prior art.

Prior to 1950 not a great deal had been done commercially with the use of pure oxygen in the refining process. McLouth contends that this lapse in the steelmaking industry was due to the unavailability of a method for producing oxygen cheaply in commercial quantities. Appellants contend that the lapse was due to the lack of an operable method for refining steel with pure oxygen. In view of the conflicting evidence, the District Court found that it was unable to ascertain a date when the use of pure oxygen in commercial quantities became economically feasible but held that the unavailability of oxygen in commercial quantities would not necessarily have inhibited experimentation. 257 F.Supp. at 398. We agree with this finding of the District Court but must also note that the lack of commercial quantities of oxygen would affect the quality of the disclosures in the prior art on matters such as specific commercial operating conditions, demonstrative examples, and the like. Moreover, the commercial unavailability of oxygen would explain the absence of any prior

attempts to apply the Schwarz and Miles Patents and would thus weaken any inferences that such a lapse in the industry might raise on the issue of obviousness. Thus, the importance of more direct evidence on the issue of obviousness becomes even more apparent.

However, the District Court found three considerations dispositive of the issue of obviousness: (1) the presumption of validity of a patent; (2) the commercial success of the basic oxygen process; and (3) secondary considerations concerning prior attempts and failures at refining steel with oxygen. 257 F. Supp. at 406. Under the facts of this case, neither commercial success nor the presumption of validity will support a finding of nonobviousness. Commercial success is a relevant consideration only in a close case; it does not by itself establish the validity of a patent. *Dow Chemical Co. v. Halliburton Oil Well Cementing Co.,* 324 U.S. 320 (1945); *Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Co.,* 340 U.S. 147 (1950). Thus consideration of commercial success should be put aside until some conclusion is reached on the basis of more direct evidence of obviousness or non-obviousness.

While it is well recognized that a patent will be presumed valid, 35 U.S.C. § 282, that presumption of validity is not conclusive and will be weakened when pertinent prior art was not considered by the Patent Office. *Harvey v. Levine,* 322 F.2d 481 (6th Cir. 1963); *Aluminum Company of America v. Sperry Products Inc.,* 285 F.2d 911 (6th Cir. 1960); *Tillotson Manufacturing Co. v. Textron, Inc., Homelite,* 337 F.2d 833 (6th Cir. 1964); *Felburn v. New York Central Railroad Company,* 350 F.2d 416 (6th Cir. 1965). In the instant case one of the most pertinent prior art patents, the Schwarz

Patent, was not cited as a reference by the Patent Office and, so far as the record indicates, was not considered by the Patent Office.[6] Avoidance of the Miles Patent as a covering reference was accomplished only by the addition of the claim "avoidance of material agitation of the bath by the oxygen stream." 257 F. Supp. at 404. The Schwarz Patent does not teach agitation of the bath by the oxygen stream; so that claim probably would not have distinguished the Schwarz Patent if it had been before the Patent Office. In similar circumstances this Court has considered that the presumption of validity was not a material factor in determining the validity of a patent. *Harvey v. Levine,* 322 F.2d 481 (6th Cir. 1963), *supra.*

Although the Appellants emphasize the lack of any previous litigation concerning the validity of the Suess Patent and the lack of interferences in the United States Patent Office, the licensing structure of BOT negatives any favorable inferences that might ordinarily arise from such circumstances. When the patentees first developed their process, they became concerned as how best to exploit the process worldwide. They realized that the Schwarz and Miles Patents might serve as interferences or as covering references. So, in the Appellants' words, ". . . to resolve any conflicting claims . . . the exploiting firm of BOT was formed." H. A.

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6. The only mention of the Schwarz Patent in the file wrapper is contained in the affidavits of Rinesch and Hauttmann. These affidavits were submitted only about two weeks before the issuance of the patent, and the record does not indicate what, if any, consideration the Patent Office gave to the affidavits. Such an offhand reference does not amount to Patent Office consideration of the prior art patent.

Brassert & Co., owner of the Schwarz Patent, and VOEST, along with several other European steel companies, were members of BOT from its inception. John Miles and Sons, Ltd., owner of the Miles Patent, became a member of BOT in 1952. The agreements with BOT were essentially license grant-backs: in exchange for placing in the BOT pool of patents their patents on certain uses of oxygen in steelmaking, the members obtained a license to utilize the processes of all other patents in the BOT pool. The agreements also contained provisions for the exchange of know-how and engineering knowledge. In 1954 Kaiser became a part of this arrangement.

Meanwhile, Dr. Suess applied for an Austrian patent on the L-D Process on January 31, 1950; and on January 16, 1951, fifteen days before the one year limitation contained in 35 U.S.C. § 119 would have barred his application, Dr. Suess applied for a patent on the L-D Process in the United States Patent Office. The continuation-in-part application on which a patent finally issued was not filed until 1955. Aside from the antitrust implications that the BOT arrangement might have, see *United States v. Singer Mfg. Co.*, 374 U.S. 174 (1963), since by 1952 it owned all of the most pertinent prior art patents, a reasonable inference might be made that the prior holders of those patents had no great interest in contesting the Suess Patent once it was issued.[7] Also, the most pertinent prior art

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7. This inference is strengthened by the agreements between BOT and its members. For example, the agreement with Brassert concerning the Schwarz Patent concludes:

"For the duration of this agreement Brassert is en-

patents, Miles and Schwarz, were not the type for which an interference would be declared by the Patent Office. See 29 U.S.C. § 135. Hence, the prosecution in the Patent Office was not all that it could have been and would have been if the prior art patents had been owned by competitors of VOEST or had been pending or unexpired United States Patents. These considerations negative any favorable inferences that might be drawn from commercial success or a lack of previous litigation.

We also find the secondary considerations that the District Court relied upon unpersuasive. The District Court found that there had been ". . . a long-standing need for such an invention; [and] . . . many unsuccessful attempts to solve the problem." 257 F. Supp. at 406. We find no evidence in the record to support that finding.

As early as the 1850's the Bessemer process taught that steel could be refined by jetting air into a molten bath of pig iron from tuyeres located in the bottom of a converter. Another line of patents going as far back as the Robert Patent in 1888 taught surface blowing with negligible penetration, 257 F. Supp. at 403. None of these processes proved successful when oxygen was substituted for air. Mere surface blowing causes a dangerous slopping condition, 257 F. Supp. at 400, and when oxygen is blown through tuyeres located in the bottom of a converter the heat of chemical reaction at the gas outlets results in severe refractory damage

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gaged to enter no complaint against any patent, which is owned or controlled by BOT and which concerned the same subject of the patent transferred by this agreement and no protest against applications of such protective rights."

and usually blows out the bottom of the converter. 257 F. Supp. at 378.

But the apparently novel disclosure in the Schwarz Patent that gas could be blown from above with such a force that it would penetrate into a molten bath of pig iron "as a solid body" made all prior attempts to solve the problems confronted by the patentees wholly immaterial. *Graham v. John Deere Co.*, 383 U.S. 1, 36 (1966). Since the Schwarz Patent was a German patent issued in 1943, it is reasonable to assume that because of World War II, it was available to the steelmaking industry as a whole by 1946 at the earliest. The Miles Patent issued in 1947 and made a disclosure similar to Schwarz's. So any problems that might have been involved in *deep* blowing had existed for a relatively short period of time prior to the 1949 Linz experiments. See *Dempster Bros., Inc. v Buffalo Metal Container*, 352 F.2d 420 (2d Cir. 1965).

Other than the Gerlafingen experiments the record does not disclose any extensive attempts and failures to refine steel by deep blowing of oxygen between 1946 and 1949. The circumstances of this case do not allow an inference of such attempts and failures from the absence of any evidence that other companies had applied the process. As to whether other steelmakers independently arrived at the same results as VOEST, the BOT arrangement made it unnecessary for that part of the industry with experience in oxygen blowing to resolve the issue. Since that arrangement provided for the exchange of know-how and engineering knowledge, it would be impossible to separate the contribution of one from the contributions of the others to the basic oxygen process as it is practiced today. So

whether the success of that process is attributable to the disclosure of the Suess Patent is unclear.

In fact, as early as May of 1949, before the Linz experiments, VOEST entered into an agreement with several other European steel companies dividing the burden of experiments in the use of oxygen steelmaking. To VOEST fell the fortuitous obligation of continuing the Gerlafingen experiments, while the other companies were to consider other uses of oxygen in steelmaking. This agreement eliminated several potential competitors of the patentees and negates any inference of extensive experimentation and failures by others skilled in the art. Why others did not avail themselves of the knowledge contained in the Schwarz and Miles Patents is not clear, but it is clear that such evidence is not conclusive on the issue of obviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 36 (1966). The failure to use a patent does not affect the validity of a patent or the persuasiveness of its teachings as a prior art reference. *Tillotson Manufacturing Co. v. Textron, Inc., Homelite,* 337 F.2d 833, 837 (6th Cir. 1964).

We also do not consider the District Court's conclusion that the Schwarz and Miles Patents are inoperable as having much relevance on the issue of obviousness.[8] This finding of the District Court was

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8. The only evidence to support the holding was the testimony of the patentees' experts, who had made no experimentations and who testified on the basis of their interpretation of deep penetration as taught by Schwarz and Miles as a penetration that damaged the refractory lining. The District Court found that Schwarz and Miles limited the penetration to a depth that would not damage the refractory lining. 257 F. Supp. at 397-8. So it is doubtfull that this evidence sup-

made in the section of the opinion concerned with the defense of anticipation and seems to have resulted from the stringent test applied in that section. Since the prior art patents did not specifically define the prescribed depths of penetration with reference to the maintenance of a fluid slag, the Court assumed that maintenance of a fluid slag was inconsistent with deep penetration as taught by Schwarz and Miles. Because a fluid slag is necessary in order to remove phosphorous, the Court concluded that the patents were inoperable. If the necessity of maintaining a fluid slag was obvious, however, so defining the depth of penetration would have been unnecessary. Therefore, to conclude from the lack of its inclusion in the definition of the depth of penetration that the characteristic itself is not comprehended within that depth of penetration begs the question when the issue is obviousness.

The application for the continuation-in-part patent was not filed until 1955, and by that time the patentees had the benefit of almost six years of experience in using the basic oxygen process plus whatever information they might have obtained through the BOT arrangement. When compared with the specifications of the parent application, the specifications of the continuation-in-part application reflect the benefit of these years of experience in the extensive discussion of the

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ports a finding of inoperability. For the same reason the Gerlafingen experiments do not prove inoperability. The District Court found that, at Gerlafingen, Dr. Durrer had not solved the refractory damage problem. 257 F. Supp. at 414. This is not a case like *Adams v. United States,* 383 U.S. 39 (1966), where an expert for the plaintiff testified *without contradiction* that he had attempted to build a battery by prior art teachings and the battery had exploded.

chemical reactions and physical phenomena that bring about the good results achieved by the basic oxygen process and in the considerable number of demonstrative examples of proper operating conditions. In comparing the disclosures of this patent with the disclosures of art prior to 1950, one must be careful to separate that part of the description containing well-known technical concepts from that part of the description that differentiates the alleged novel concept of the patentees from the prior art. So far as the District Court went in determining the differences between the disclosures of the Suess Patent and the disclosures of the prior art, we think it did an excellent job in separating the technical descriptions from the decisive distinctions. Therefore a concise statement of those findings will suffice.

Without considering the implications of the first claim of the Suess Patent,[8a] the Court found that patent's teachings to be: (1) that pure oxygen should be used; (2) that it should be blown from above onto and below the surface of the molten bath; (3) that the blowing should be carried out by means of a vertical or almost vertical lance located so that the oxygen jet impinges on the surface of the molten bath at or near the center of the upper surface; (4) that the pressure and nozzle arrangement should be such as to avoid deep

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8a. Since the invention is measured by the claims, perhaps the District Court should have first determined what the claims described as the invention, which the Court later found was not "avoidance of deep penetration". Although the approach causes some confusion, we follow it for the purpose of analyzing the District Court's conclusion on obviousness. See also footnote 1a, *supra*.

penetration of the jet into the bath; and (5) that sufficient heat for the process is produced autogenously in a limited center of chemical reaction spaced a substantial distance away from the refractory lining.

The Schwarz Patent was found to teach: (1) that oxygen enriched air or oxygen should be used; (2) that it should be blown from above into the bath "as a solid body"; (3) that the pressure and nozzle arrangement should be such that the jet penetrates deeply into the bath; and (4) that sufficient heat for the process is produced autogenously in a limited center of chemical reaction located a substantial distance from the refractory lining.[9] Schwarz contained no disclosure concerning the angle of the oxygen lance.

The Miles Patent was found to teach: (1) that an oxygen-nitrogen mixture containing 70% — 98% oxygen should be used; (2) that it should be blown from above with sufficient speed to penetrate into the bath; (3) that the blowing should be carried out by means of a lance placed at an angle of between 15 and 90 degrees to the bath surface, an angle of 30 — 75 degrees being recommended; (4) that the jet should agitate the bath; and (5) that sufficient heat for the process is produced autogenously in a limited center of chemical reaction spaced a substantial distance from the refractory lining.[10] Miles contained no specific teaching of deep penetration, but the District Court implied such a teaching from the recommendation that the gas should be jetted at a supersonic speed.

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9. Disclosure (4) is a paraphrase of the finding of the District Court at page 404 of its Opinion, rather than a paraphrase of the patent.

10. See footnote 9 concerning disclosure (5).

The use of pure oxygen is not claimed as inventive. Nor is the use of a vertical lance located so that the oxygen jet impinges on the molten bath at the center of the upper surface claimed as inventive in view of Miles' suggestion of a 90 degree angle. And the District Court found that the autogenous production of heat in a limited center of chemical reaction located a substantial distance from the refractory lining could not be claimed as an advance over the prior art. In sum, the only difference between the Suess disclosure and the prior art is the teaching of avoidance of deep penetration as opposed to deep penetration.

The difficulty arises in attempting to determine whether that distinction is merely verbal or whether it encompasses a concept that prior to 1950 would have been unobvious to a perso skilled in the art. In determining the meaning of "avoidance of deep penetration," the District Court found that the only manner in which that term could be defined was by characteristics of the process. 257 F.Supp. at 400-402. Expert opinion on the percentage of bath depth that was encompassed by "avoidance of deep penetration" varied from thirty per cent to anything less than ninety per cent. 257 F. Supp. at 402. Although depth of penetration is directly related to the pressure and nozzle configuration employed and inversely related to the distance of the lance tip from the bath surface, whether certain arrangements of pressure, nozzle configuration, and bath distance would result in "avoidance of deep penetration" would depend upon the size and depth of the bath.

The characteristics of the process that would place limitations on the depth of the penetration and that

would meaningfully define the depth to one skilled in the art were found to be slopping, refractory damage, and fluidity of the slag. 257 F. Supp. at 402. The District Court found that the specifications of the Suess Patent defined "avoidance of deep penetration" as a penetration sufficient to avoid slopping but not deep enough to seriously impair refractory life or to prevent the formation of the fluid slag necessary for phosphorous removal. However, the Court found that both Schwarz and Miles similarly defined "deep penetration" as a penetration sufficient to avoid slopping but not deep enough to seriously impair refractory life. So it is apparent that the only meaningful distinction between the Suess Patent and the prior art patents is not precisely defined by the antithetical "avoidance of deep penetration" but by the teaching of the necessity of forming and maintaining an early fluid slag.

At this point the District Court should have determined what the prior art taught concerning the necessity of a fluid slag, the method of obtaining a fluid slag, and the feasibility of the suggested method. Having concisely defined the difference between the depth of penetration taught by Suess and the limitation on depth of penetration as "clearly defined" by Schwarz and Miles, the District Court failed to take this further step. Instead, the Court fell back upon the otherwise meaningless antithesis and apparently assumed, since deep penetration was not clearly limited by the teaching of formation of a fluid slag, that maintenance of a fluid slag could not be comprehended by that depth of penetration.

Persuasive evidence in the record, however, indicates that the prior art was aware of the necessity of

maintaining a fluid slag. As indicated, the purpose of the fluid slag is to remove phosphorous; and on this point the Miles Patent teaches that "the silicon and the phosphorous pass into the slag." In explaining the functioning of the slag, Miles further teaches that "the high speed jet causes a vigorous agitation and an entrainment of the slag in the body of the metal, thus assuring an intimate mixture and rapid reactions . . .[and] in each of these cases, the oxygen of the jet reacts not only with the constituent elements of the metal *but also with the slag, thus increasing the oxygen content of the latter and therefore the oxidizing* reactions in general . . . [and further] the jet actually strikes the slag at the surface of the molten metal and acts on the metal by passing through the slag and reaching the metal and/or *by renewing the slag so as to regenerate or increase its power to act on the metal.*" (Emphasis added) Miles also teaches that the speed of the jet of oxygen can be varied, which to one skilled in the art is the same as teaching that the amount of penetration can be varied, and that "[t]he course of the refining can be controlled . . . by varying the velocity of the gases . . ." These disclosures appear clearly to teach that phosphorous is removed by reactions with the slag, that the oxygen jet reacts with the slag and increases the slag's reaction capabilities, and that the course of the refining can be controlled by varying the amount of penetration of the jet. In addition, Dr. Chipman, the patentees' expert, testified that a knowledgeable person skilled in the art would know what he should do to obtain an active slag.

On the other hand, Appellants contend that persons skilled in the art prior to 1950 were so concerned with stirring the bath by the oxygen stream that they would

not have thought refining possible at a depth of penetration where a fluid slag is maintained. The recommendation of supersonic speeds in the prior art patents lends some credence to this assertion. Also, the Gerlafingen experiments show that at least one experimenter had not solved the refractory damage problem. The failures at Gerlafingen, however, are more readily explainable by the cumbersome nature of the equipment used[11] than by any "blind spot" concerning the stirring of the bath. In any event, such an isolated incident can hardly prove that persons skilled in the art in the entire steelmaking industry had a "blind spot" concerning the depth of penetration that would cause them to ignore the other teachings of Schwarz and Miles.

The District Court's conclusion of nonobviousness could have been affirmed if other evidence, whether relied upon or not, had supported that conclusion. *Cold Metal Process Co. v. McLouth Steel Corporation,* 126 F.2d 185 (6th Cir. 1942). Other evidence, however, leaves that conclusion considerably in doubt. On the other hand, if the disclosures of the Miles Patent were the only evidence on obviousness, this Court could reverse, making a finding of obviousness on the disclosures of that document. See *Shumaker v. Graboski In-*

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11. The gist of the negotiations preceding the transfer of the oxygen blowing experiments from Gerlafingen to Linz was that the transfer was made because Gerlafingen did not have an oxygen plant and because other factors made experimentation cumbersome. In addition Dr. Trenkler testified that the lance used at Gerlafingen could not be raised or lowered during the process. Also Dr. Durrer testified that the experiments were moved to Linz because of the better conditions there.

dustries, Inc., 352 F.2d 837 (7th Cir. 1965); *Letcher County, Ky. v. Defoe*, 151 F.2d 987 (6th Cir. 1946). Conflicts in the evidence, however, require factual determinations which are best entrusted to the District Court in the first instance, and which the District Court did not make in this case. However, the case need not be remanded for further findings because the District Court can be affirmed on another ground.

Assuming that "avoidance of deep penetration" defines some meaningful concept, the claim of the Suess Patent does not describe that concept as the subject matter of the invention and does not distinguish the alleged invention from the prior art. Apparently the patentees were aware that, when it is once admitted that the oxygen jet penetrates into the bath to any not insubstantial degree, it becomes almost impossible to distinguish "deep penetration" as taught by Schwarz and Miles from "avoidance of deep penetration" as taught by the patentees. The various patent applications on the L-D Process reflect this difficulty. When confronted by an interference by the Schwarz Patent in making application for a German patent, Dr. Suess replied:

> "In contradistinction to . . . [Schwarz], in the case of the present invention the molten bath is blown with so little kinetic energy that the oxygen does not penetrate. . . ."

And later to further opposition Dr. Suess again replied:

> ". . . the oxygen is not blown into the molten bath, but rather onto the surface of the bath and reacts at the surface. . . The jet of oxygen . . . acts only on the surface. . ."

Likewise in their Australian application for a patent the patentees stated that ". . . the gas jet does not penetrate into the bath of molten metal . . . [and further] an essential characteristic of the invention is that the gas jet does not penetrate into the bath . . ." In other applications the amount of penetration was not even urged as the gist of the invention; rather the patentees contended that the good results of the L-D Process were due to the maintenance of a proper ratio between the bath surface and the bath depth.[12]

Standing alone, this evidence of statements in foreign applications for patents would not necessarily bind the patentees to any particular description of avoidance of deep penetration. The same arguments, however, were used in the prosecution of the United States applications. When confronted by interference from the Miles Patent, the patentees stated:

> "[the] . . . conditions of blast nozzle operation . . . distinguish the applicant's method from the Miles et al. method in emphasizing a much lower impingement pressure and a practically negligible penetration of the surface of the molten metal by the oxygen jet . . . [and also] it will be evident that the blast velocity at the surface of the bath will be insufficient to cause any substantial penetration of the bath by the jet."

Also in an attempt to obtain a patent after a protracted prosecution in the Patent Office, Dr. Rinesch and Dr. Hauttmann, two of the patentees, filed affidavits to dis-

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12. This ratio theory was also the basis of the earlier Suess application, which was rejected by the United States Patent Office and finally abandoned.

tinguish the Miles and Schwarz methods of deep blowing. To support their claim that "avoidance of deep penetration" was "just the opposite of the methods disclosed in the Schwarz and Miles et al. patents. . ." Dr. Rinesch stated that the jet did not penetrate "appreciably" into the bath and further limited the center of reaction to the "surface layer". Likewise, Dr. Hauttmann limited the reactions caused by the oxygen jet to "the surface layer of the bath".

On the basis of this evidence the District Court found:

> "Clearly the patentees and their attorneys defined the avoidance of deep penetration as practically no penetration at all in order to distinguish the prior art for purposes of prosecuting their own patent applications."

Having consistently and repeatedly limited "avoidance of deep penetration" to a "practically negligible" penetration or to a "surface layer" penetration or to no penetration when faced with an interference from the Schwarz and Miles Patents, both in the United States Patent Office and in foreign patent offices, the patentees now seek a broader description of that term encompassing any penetration of one half the bath depth or less.

Dr. Trenkler testified that "avoidance of deep penetration" meant a penetration of from one-third to one-half the bath depth. Dr. Hauttmann testified that the L-D Process involved a penetration of not more than one-half of the bath depth. Appellants' experts also testified concerning an "avoidance of deep penetration" that was considerably more than negligible. 257 F. Supp. at 402. We held in *Thabet Mfg. Co. v Kool Vent*

Metal Awning Corp., 226 F.2d 207 (6th Cir. 1955), that, when a patentee defines a term and the Patent Office accepts that interpretation, the Court will give the same interpretation to the term. In prosecuting their patent application, the patentees clearly limited "avoidance of deep penetration" to a "practically negligible" penetration. The Patent Office accepted that interpretation of the term; so the patentees are not now entitled to an interpretation of "avoidance of deep penetration" encompassing more than the limitation accepted by the Patent Office. *Westinghouse Electric Corp. v. Hanovia Chem. & Mfg. Co.*, 179 F.2d 293 (3rd Cir. 1949); *Doran Coffee Roasting Co. v. Wyatt Manufacturing Co.*, 267 F.2d 200 (10th Cir. 1959).

Appellants have insisted throughout this case that they regard the subject matter of the patentees' invention to be "avoidance of deep penetration". The proposition is too well settled to need citation that the claims measure the invention. Congress has provided in 35 U.S.C. § 112:

> "The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention."

The Suess Patent concluded with two claims, only one of which need be considered. Claim 1 of the Patent states:

> "1. Method of refining molten impure iron in the presence of a slag in a vessel having a refractory lining by blowing with oxygen, which comprises discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath at the central portion thereof,

> to an extent to avoid material agitation of the bath by the oxygen stream, the contact of the oxygen with the bath resulting in reaction of the oxygen with a portion of the iron and with the oxidizable impurities of the bath in a localized reaction zone spaced a substantial distance from the refractory lining, the reactions in said zone resulting in refining of the iron and gas evolution and in the production of high temperature in the reaction zone away from the refractory lining, said reaction producing a circulatory movement in the molten metal, which circulatory movement brings those portions of the molten metal bath which are remote from the reaction zone into the reaction zone whereby those portions are subjected to said reaction with minimum injury to the refractory lining."

No express reference to "avoidance of deep penetration" is made in the claim. Appellants attempt to incorporate the term in the claim by relating it to the phrase ". . . to an extent to avoid material agitation of the bath by the oxygen stream . . ." and to the phrase ". . . contact of the oxygen with the bath resulting in . . . a localized reaction zone spaced a substantial distance from the refractory lining . . ." Yet neither of those phrases can be interpreted as limiting the penetration of the oxygen stream to a "practically negligible" penetration. In the case of an improvement patent, the United States Supreme Court stated in *Halliburton Oil Well Cementing Co. v. Walker,* 329 U.S. 1 (1946), that a patentee cannot obtain greater coverage for his patent by failing to describe his alleged invention than by describing it as the statute commands. We find that rule just as applicable to a process patent.

In the specifications of the Suess Patent no description of the process refers to material agitation of the bath by the oxygen stream, and no description relates agitation or the avoidance of agitation to the depth of penetration of the oxygen jet. The District Court found that the phrase "material agitation" had no meaning to one skilled in the art, and we find that ruling amply supported by the evidence. Appellants contend, however, that the phrase must be given the meaning attributed to it by the patentees as reflected in the affidavits of Dr. Rinesch and Dr. Haut' nann. In so contending the Appellants urge this Court to place an unreasonable construction on the rule stated in *Kool Vent*. That case in effect held that when a patentee places a certain limitation upon a term used in his patent he cannot later expand the scope of the term by ignoring his earlier restrictive interpretation. Appellants would have us read the rule as permitting a patentee to give meaning to a meaningless term through affidavits submitted to the Patent Office and filed somewhere obscurely in the file wrapper history of the patent.

The patent law does not require a prospective inventor to search so far in attempting to determine the scope of a patent and the areas left open for inventive inquiry. Section 112 provides that it is the claims that shall *particularly point out* and *distinctly* claim the subject matter of the patentee's invention. Certainly, terms used in the claims can gain meaning from the specifications or from the knowledge attributable to one skilled in the art. But a prospective inventor is required to go no further in attempting to determine the invention claimed and the areas foreclosed to future enterprise. When read in light of the specifications,

these claims would not describe a "practically negligible" penetration to one skilled in the art. Hence, the patentees failed to describe their invention.

The only meaningful limitation placed on the depth of penetration of the oxygen stream is the phrase ". . . a localized reaction zone spaced a substantial distance from the refractory lining." The District Court found that both Schwarz and Miles placed the same limitation on depth of penetration. So if the only difference between the patentees' process and the process taught by Schwarz and Miles is the depth of penetration of the oxygen stream, the patentees have failed to distinguish their depth of penetration in any way from the depth of penetration taught by the prior art. We recently held in *Holstensson v. V-M Corporation,* 325 F.2d 109 (6th Cir. 1963), that a policy in the patent law ". . . visits total forfeiture upon a patent which attempts to extend its monopoly to something already patented." 325 F.2d at 122. That case concerned an improvement patent, but we find the rule just as applicable to the patent in suit.

In our view of this case, the Appellants ask this Court to ignore the precision of definition required of them by the statute. As the Supreme Court noted in *United Carbon Co. v. Binney Co.,* 317 U.S. 228 (1942), to allow claims "so indefinite as not to give the notice required by the statute would be in direct contravention of the public interest which Congress . . . recognized and sought to protect." In that case the Court considered a product patent where the distinction from the prior art was a matter of degree. The Court rejected terms, such as "substantially pure", "commercially uni-

form", and "comparatively small", that gave no standard for comparison or were so indefinite as to have no established meaning to one skilled in the art.

Likewise, in the instant case we are concerned with a patent that varies from the prior art only in the alleged degree of penetration of the oxygen stream. But the only term allegedly defining that difference has no established meaning. When patentees' experts were asked when agitation became material, they uniformly replied, "I don't know." As indicated earlier the specifications nowhere establish a standard for determining when agitation becomes material and nowhere relates the amount of agitation to the depth of penetration. The knowledge attributable to one skilled in the art will also not aid the patentees in reading their alleged invention into the claim. Whatever interpretation one skilled in the art might have placed on "avoidance of material agitation", it would not have been the "practically negligible" penetration that the patentees represented to the Patent Office as "avoidance of deep penetration." The District Court found that continued shallow blowing causes a turbulent slopping condition.

Although a slopping condition might appear inconsistent with what the specifications would teach one skilled in the art concerning the depth of penetration of the oxygen stream, the inconsistency arises because of the inconsistent positions that the patentees assumed before the Patent Office. If the patentees had contended for the amount of penetration before the Patent Office that they now urge upon this Court, their patent would probably not have passed muster. The inconsistency could have resulted from the rather indeter-

minate nature of the patentees' advance over the prior art, or it could have resulted from an attempt to get an artfully worded restatement of the prior art through the Patent Office. Under similar circumstances in the *Binney Co.* case the Supreme Court stated:

> "Whether the vagueness of the claim has its source in the language employed or in the somewhat indeterminate character of the advance claimed to have been made in the art is not material. An invention must be capable of accurate definition, and it must be accurately defined, to be patentable." 317 U.S. at 237.

We find that the patentees failed to define their alleged advance over the prior art and that in failing to properly limit their claims they attempted to extend their monopoly to something already patented. For either reason, or for both reasons, the patent must be held invalid.

Even if "avoidance of deep penetration" could be given a broader meaning than "a practically negligible penetration", another reason prevents the claims from being read so as to contain that limitation. The District Court found that the doctrine of file wrapper estoppel prevented the patentees from incorporating the limitation of "avoidance of deep penetration" into their Claim 1. If the patentees cannot limit their claim to this sole patentable advance over the prior art, the patent is invalid regardless of any other findings of the District Court. Resolution of the question requires certain factual inquiries into the file wrapper history of continuation-in-part Application No. 547,233.

In attempting to apply the doctrine of file wrapper estoppel to the facts of the instant case, two considerations must be borne in mind: (1) 35 U.S.C. § 282 specifically provides that a patent shall be presumed to be valid and the burden of proving invalidity shall rest upon the person asserting that the patent is a nullity; thus, in the present case McLouth has the burden of proving that the patent is void; and (2) the estoppel is invoked in connection with the plaintiff's attempt to satisfy that requirement of 35 U.S.C. § 112 which provides, "the specifications shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention."

The basic principle underlying file wrapper estoppel is that "a party cannot take inconsistent positions concerning the same subject matter in different transactions." 4 Walker, Patents § 234, p. 87 (Deller 2.d ed. 1965). In making its holding concerning file wrapper estoppel, the District Court relied heavily upon *Schriber-Schroth Co. v. Cleveland Trust Co.*, 311 U.S. 211 (1940). There the Court phrased the doctrine in these words:

> "But the particular invention to which the patentee has made claim in conformity to the statute is not always to be ascertained from an inspection of the specifications and claims of the patent alone. Where the patentee in the course of his application in the patent office has by amendment cancelled or surrendered claims, those which are allowed are to be read in the light of those abandoned and an abandoned claim cannot be revived and restored to the patent by reading it by construction into the claims which are allowed." 311 U.S. at 218.

Hence, the determinative question on this issue is whether the Appellants did in fact cancel, surrender, or abandon the claim of "avoidance of deep penetration by the oxygen stream" during the prosecution of Patent Application No. 547,233.

In *Schriber,* cited by this Court in *Bobertz v. General Motors Corporation,* 228 F.2d 94 (6th Cir. 1955), the Supreme Court said:

> "It is a rule of patent construction consistently observed that a claim in a patent as allowed must be read and interpreted with reference to claims that have been cancelled or rejected, and the claims allowed cannot by construction be read to cover what was thus eliminated from the patent. [Citing cases.] The patentee may not, by resort to the doctrine of equivalents, give to an allowed claim a scope which it might have had without the amendments, the cancellation of which amounts to a disclaimer. (Citing cases.)
>
> The injurious consequences to the public and to inventors and patent applicants if patentees were thus permitted to revise cancelled or rejected claims and restore them to their patents are manifest. See Leggett v. Avery, 101 U.S. 256, 259, 25 L.Ed. 865.
>
> "True, the rule is most frequently invoked when the original and cancelled claim is broader than that allowed, but the rule and the reason for it are the same if the cancelled or rejected claim be narrower. (Citing cases, Cf. Smith v. Magic City Kennel Club, Incorporated, 282 U.S. 784, 790, 51 S. Ct. 291, 75 L.Ed. 707)." 311 U.S. at 220-1.

In making this determination the only pertinent material in the file wrapper history of Application No. 547,233 would appear to be the parent patent Application No. 206,147 together with Patent Office correspondence, the present patent and answers of the Examiner concerning prior rejected claims, the patents against which Application No. 547, 233 was compared,[13] and the affidavits submitted with the final change in claims.[14]

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13. In the prosecution of Application No. 547,233 perhaps the Examiner considered some patents as prior art, which should not have been so considered. (e.g. the Cuscoleca Patent, filed on December 22, 1954). But whether the patentee could have been legally required to give up the claim surrendered is immaterial, the question in applying the doctrine of file wrapper estoppel is whether the patentee did *in fact* give up the claim. If the patentee disagreed with the Examiner, his remedy was appeal; he cannot give up the claim and then attempt to recover it through collateral infringement suits. *Schriber-Schroth Co. v. Cleveland Trust Co.*, 311 U.S. 211, 221 (1940). Therefore in determining what was abandoned in the rejected claims, all of the patents with which No. 547,233 was compared must be considered. Those patents were: (foreign patents are designated as such) Miles Patents (British and French)

Potts Patent (British)
Cuscoleca Patent
Cheswick Patent
Kalling Patent
Brassert Patent

Only the Cuscoleca Patent is included in the record on appeal. The assumed conflict with the other patents must be determined from correspondence in the file wrapper history of No. 547,233 and No. 206,147.

14. Although these affidavits might not be pertinent in determining other issues, such as whether the specifications support the claims, *Cf. Tillotson Mfg. Co.*

When making the parent Application, No. 206,147, in 1951, Dr. Suess did not emphasize avoidance of deep penetration as of any great significance in the process. Only one off-hand reference was made in the description that a certain pressure and nozzle arrangement would bring "about a sufficiently high reaction velocity without deep penetration of the gas into the molten bath." No claim referred to avoidance of deep penetration as an element of the process. After final rejection of No. 206,147, the Appellants on March 20, 1956, cancelled all prior claims and submitted two claims to place "the case in better form for consideration on appeal." In one of those claims, Claim 14, a reference was made to avoidance of "deep penetration of the oxygen jet into the molten metal."[15] This entire Application

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v. Textron, Inc., Homelite, 337 F.2d 833 (6th Cir. 1964), it seems that they would be appropriate considerations in determining exactly what elements of the prior claims were abandoned on submission of the final claims, in absence of other more direct evidence.

15. Section 120 of Title 35 of the United States Code grants the benefit of the earlier filing date of the parent patent, to a continuation-in-part patent when the invention was "disclosed in the manner provided by the first paragraph of Section 112 . . . in . . ." the earlier "application previously filed . . . by the same inventor . . ." Since the continuation-in-part application was made in 1955 and since the only claim containing any reference to the subject matter of avoidance of deep penetration was not made until 1956, apparently as an after-thought, some question might be raised whether the alleged invention of avoidance of deep penetration is entitled to the benefit of the earlier filing date. *Merry Manufacturing Company v. Burns Tool Company,* 335 F.2d 239 (5th Cir. 1964). If it was not so entitled, the claim would be barred by Dr. Suess' 1950 Austrian patent. 35 U.S.C. § 119. That issue, however, has not been raised in this case.

was abandoned before any Patent Office action was taken; so none of the Patent Office correspondence on No. 206,147 has much relevance on the issue of file wrapper estoppel.

Application No. 547,233, however, does make references to "avoiding deep penetration by the oxygen jet." That phrase is incorporated into each of Claims 1 through 4. In the Patent Office rejection of these claims the Examiner held them unpatentable over Brassert and Cheswick and Kalling. Brassert was said to disclose "the use of a blast of oxygen into the surface of the molten metal . . ." and "regulating the pressure and amount of the compressed air or blast . . ." Cheswick was said to disclose "the use of an oxygen blast upon the surface of molten steel for refining purposes," and Kalling was said to make the use of surface blowing "to prevent local attacks upon the furnace lining" old art. Claims 1 through 15 were rejected over the Miles French Patent and Cuscoleca. Miles was said to disclose surface blowing "with a pressure of 7 to 8 atmosphere." Most of the indicated conflicts relate in some manner to the penetration of the oxygen stream: (1) surface blowing implies very little, if any penetration; and (2) the depth of penetration is directly related to the pressure with which the oxygen is blown. On the other hand, the Examiner did not mention avoidance of deep penetration directly as a conflicting element.

The Appellants, in response to the rejection, cancelled Claims 1 through 10 but amended Claim 12 to include the statement "to avoid substantial penetration of the jet into said bath." Also Claim 16 was added, which included in it the statement, "the pressure and nozzle

spacing being related to avoid deep penetration of the oxygen jet into the molten metal." The remarks following the submission of these amendments make it clear that the Appellants considered avoidance of deep penetration an important part of the invention, specifically emphasizing "the very important particular of depth of penetration of the molten bath by the jet of oxygen."

The Patent Office never took action on these claims. Pursuant to a discussion with the Examiner, however, the amended Claims were cancelled, and Claims 17 and 18 submitted in their place. These new Claims, which with minor amendments became the final Claims, did not contain any direct reference to avoidance of deep penetration. Also the remarks accompanying the submission of the new Claims contained no reference to avoidance of deep penetration. The only references were contained in affidavits submitted by two of the patentees, Dr. Rinesch and Dr. Hauttmann.

We believe that sound inferences can be drawn from the Patent Office's rejections of earlier claims which contained the element of avoidance of deep penetration and its reference to the Cuscoleca Patent. Although the record is void as to the content of the discussion with the Examiner on May 1, 1957, we believe that an inference of abandonment can be drawn from the omission of "avoidance of deep penetration" from the final claims. In our opinion, if the element was as important as the affidavits imply, it would have been explicitly included in the claims; the Patentees were well aware that our patent laws require that the claims "distinctly" claim the alleged invention. The Appellants cannot regain the phrase or qualify the effect of their acquiescence

through the affidavits. *Parke, Davis & Co. v. American Cyanamid Co.*, 207 F.2d 571, 574 (6th Cir. 1953). In the face of prior rejections, the claim allowed, cannot, by construction or affidavit, be read to cover that which was specifically abandoned by the patentee so as to give the allowed claim a scope it might have had without the omission of the language.

In this case the issue of file wrapper estoppel hinges entirely upon the factual determination of abandonment or non-abandonment.[16] While the record does not indicate whether the District Court made any extensive factual inquiry into this problem, we believe the Court was correct in its view that abandonment is established if a phrase used in an abandoned or rejected claim is not used in a later accepted claim.

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16. Certain assertions made by the Appellants deserve comment at this point. The argument that "avoidance of deep penetration" was included in Amended Claim 12 and added Claim 16 and that these Claims were *never rejected* is immaterial except for the factual inferences that might be drawn. The doctrine is equally applicable to claims given up informally pursuant to a discussion or conference as to claims given up after a formal rejection. *Graham v. John Deere Co.*, 383 U.S. 1, 32-3 (1966). That the claims allowed were broader than they would have been if the omitted phrase had been included is likewise immaterial. *Schriber-Schroth Co. v. Cleveland Trust Co.*, 311 U.S. 211, 221 (1940). As pointed out earlier, the accompanying affidavits cannot be utilized to recover the abandoned claim if its relinquishment was in fact required by the Examiner during the "discussion". *Parke, Davis & Co. v. American Cyanamid Co.*, 207 F. 2d 571 (6th Cir. 1953). The only disputable finding, therefore, is the factual determination of abandonment.

The determination being essentially a factual one, prior cases do not offer any clear-cut guide lines concerning what constitutes abandonment or non-abandonment. Most of the cases involved a *limitation* specifically imposed upon the claims by the Applicant and the Applicant was precluded in a later infringement suit from placing a broader interpretation on the Claims.[17]

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17. In these cases the factual determination was easier, because it is easier to prove the purpose of a positive occurrence such as an inclusion of an element than to prove the purpose of a negative occurrence such as the omission of an element. Was the omission made purposely or was it made under the assumption that an included phrase was the omitted phrase's equivalent? The difficulty of the determination is compounded when the final claim is broader than the cancelled claim. See *Graham v. John Deere Co.*, 383 U.S. 1, 32-3 (1966) (limitations were specifically spelled out in remarks accompanying the final submission); *Exhibit Supply Co. v. Ace Corp.*, 315 U.S. 126, 136-7 (1942) (claims limited to conductors embedded in table clear from prior rejected claims); *Keystone Co. v. Northwest Eng. Co.*, 294 U.S. 42, 47-9 (1935) (limitation clear from letter from applicant's solicitor); *Smith v. Magic City Kennel Club, Inc.*, 282 U.S. 784, 788-9 (1931); (limitation clear from prior rejection references); *I. T. S. Rubber Co. v. Essex Rubber Co.*, 272 U.S. 429, 439 (1926) (limitation clear from prior rejection reference); *Parke, Davis & Co. v. American Cyanamid Co.*, 207 F.2d 571, 574 (6th Cir. 1953) (limitation clear from statements of Patent Office); *Lyon, Inc. v. Clayton & Lambert Mfg. Co.*, 127 F.2d 164 (6th Cir. 1942) (facts not clear); *Valjean v. Perfection Stove Co.*, 103 F.2d 60, 61-2 (6th Cir. 1939) (limitations clear from rejection reference and statements of Patent Office); *Bishop & Babcock Mfg. Co. v. Western Auto Supply Co.*, 105 F.2d 886, 889 (6th Cir. 1939) (limitation clear from representations to Patent Office); *Firestone Tire & Rubber Co. v. United States Rubber Co.*, 79 F.2d 948, 954-5 (6th Cir. 1935) (limitation clear from rejection reference).

Here the process was reversed; the Applicant was refused a narrow claim and granted a broader claim. Although this difference does not affect the application of the doctrine of file wrapper estoppel, it does make the factual determination more difficult. In relying upon *Schriber-Schroth Co. v. Cleveland Trust Co.,* 311 U.S. 211 (1940), the District Court chose the case most directly in point factually with the instant situation.

Many of the facts in the *Schriber Co.* case are identical to the instant case. The question in *Schriber Co.* was whether the Jardine Patent for a piston contained a claim of a flexible web feature. 311 U.S. at 218. As the Applicants in the instant case, Jardine did not claim flexible webs as a feature in the claims originally filed; and while the application was pending, Jardine amended the claims to supply this omission; here the patentees filed a continuation-in-part application to supply the omissions. As in the instant case, these claims were rejected as reading upon other patents; as a result the claims were cancelled and new claims submitted that did not contain a claim for flexible webs. Also as here, the claims that were finally allowed were broader than if the omitted claim had been included. Appellants attempt to distinguish *Schriber Co.* on the grounds that in that case the limiting phrase was omitted as the result of an interference proceeding. That fact cannot be a distinguishing feature of the case, however, see *Graham v. John Deere Co.,* 383 U.S. 1, 32-3 (1966); otherwise, the doctrine of file wrapper estoppel would never apply to a patent where, as in the instant case, the only pertinent prior art consisted of foreign patents, because interference proceedings will not be de-

clared on such patents by the Patent Office. 29 U.S.C. § 135.

The District Court concluded that *Schriber Co.* controlled the result concerning file wrapper estoppel. Judge Weick and I agree. Judge Edwards joins in the opinion in all respects except that he does not feel that the defense of file wrapper estoppel is established by the record.

Affirmed.

Judgment of Court of Appeals

[Entered August 2, 1968]

Before: WEICK, Chief Judge, EDWARDS and CELEBREZZE, Circuit Judges.

JUDGMENT

APPEAL from the United States District Court for the Eastern District of Michigan

THIS CAUSE came on to be heard on the record from the United States District Court for the Eastern District of Michigan and was argued by counsel.

ON CONSIDERATION WHEREOF, It is now here ordered and adjudged by this Court that the judgment of the said District Court in this cause be and the same is hereby affirmed.

It is further ordered that Defendant-Appellee recover from Plaintiffs-Appellants the costs on appeal, as itemized below, and that execution therefor issue out of said District Court.

Entered by order of the Court.

CARL W. REUSS
Clerk

Order of Court of Appeals Denying Petition for Rehearing

[Dated September 10, 1968]

Before: WEICK, Chief Judge, EDWARDS and CELEBREZZE, Circuit Judges.

Upon consideration of Appellants' petition for rehearing in banc, and no request having been made by a "judge in regular active service or a judge who was a member of the panel that rendered [the] decision sought to be reheard" for a vote on Appellants' suggestion, Rule 35(b), Federal Rules of Appellate Procedure, the petition has been referred to the panel that rendered the decision sought to be reheard. Upon due consideration thereof, it is ORDERED that the petition for rehearing be, and it is, hereby denied.

ENTERED BY ORDER OF THE COURT

CARL W. REUSS
Clerk

Opinion of the District Court

[Filed July 6, 1966]

FREEMAN, District Judge.

This is an action for infringement of patent No. 2,800,631 involving a process of making steel by jetting high purity oxygen downwardly onto a bath of molten pig iron. The patent was issued July 23, 1957, to four Austrian steelmakers, Drs. Theodor Eduard Suess, Herbert Trenkler, Hubert Hauttmann and Rudolf Rinesch, as joint inventors, on the basis of experimentation with the use of pure oxygen in steelmaking dating back to June of 1949. At that time, all four men were employed by plaintiff Vereinigte Oesterreichische Eisen-und Stahlwerke Aktiengesellschaft (hereinafter called "VOEST") a steel company owned by the Austrian Government having its main factory at Linz, Austria. VOEST is presently owner of the patent in suit and all rights pertaining thereto, by virtue of assignment from the patentees. Other plaintiffs in this litigation are Brassert Oxygen Technik AG., (hereinafter called "BOT"), a Swiss corporation which is the exclusive world-wide licensing firm for the patent in suit; and Henry J. Kaiser Company (hereinafter called "Kaiser"), a Nevada corporation which is the exclusive licensing agent in the United States for the patent.

Defendant in this case is McLouth Steel Corporation (hereinafter called "McLouth"), a Michigan corporation having a place of business at Trenton, Michigan, where a steel plant is located, whose operations are alleged to infringe the patent in suit.

The oxygen steelmaking process at issue in this litigation has demonstrated in recent years undoubted advantages over older methods of steelmaking, including reduction of capital and operating costs, increase of production rates, and improvement [2] in quality of the steel produced. Therefore, perfection of the process has resulted in its large-scale adoption in the United States and throughout the world. Defendant McLouth has admitted that the new oxygen steelmaking process is "a revolutionary method of making high quality steel." (PX 96A; R. 1107, 1510.) Additionally, the process has been characterized by the President of Jones & Laughlin Steel Company as "the only major technological breakthrough at the ingot level in the steel industry since before the turn of the century." (PX 92-7; R. 1233-34.)

Basically, plaintiffs contend that the four patentees were joint inventors of this oxygen steelmaking process at Linz, Austria, in June of 1949, and that the process is the subject matter of the patent in suit, allegedly infringed by McLouth. Defendant denies these contentions and also asserts a defense of patent misuse.

I. BACKGROUND OF THIS LITIGATION

A brief discussion of the background of this litigation may serve to clarify the issues and also to provide a general perspective for the more detailed analysis of each issue to follow.*

[3] A. Steelmaking Prior to the Tests At Linz, Austria, in 1949

Steel is simply iron containing a very small percentage of other elements such as carbon, phosphorus, manganese, silicon and sulphur. Iron is found in nature in oxide forms, mixed with impurities. Thus the proc-

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*The litigation has been unusually long and complex. After several years of pretrial research, experimentation and discovery, the case came to trial in October, 1963. Trial of the case required 150 days of court time, spread over an entire calendar year. More than 13,800 pages of testimony were taken, consisting largely of scientific evidence, much of which required the use of interpreters. A great number of exhibits were received in evidence, including large testing equipment, test pieces, and many demonstration movie films, as well as a considerable volume of documentary evidence. At the conclusion of the trial, briefs were prepared and submitted by the parties, totaling nearly 1000 printed pages. Final arguments lasted five days.

The Court expresses grateful appreciation to the parties and counsel for their consideration in providing the Court with a daily transcript of the testimony, bound regularly from time to time in convenient book form and also reproducing most of the documentary exhibits in uniform size and placing them in looseleaf binders for the Court's convenience. The testimony and documentary exhibits in such form occupy approximately an equal amount of library shelf space, totaling more than twelve feet.

ess of steelmaking involves reduction of iron oxide to pure iron and the removal of impurities to acceptable levels for the quality of steel desired. The blast furnace, an invention probably of Chinese origin and introduced in Europe in the sixteenth century, performs the function of reducing iron ore to relatively pure iron, but fails to separate other elements from the iron sufficiently to produce steel. In fact, the iron produced by the blast furnace, known as pig iron, acquires roughly four per cent carbon as a result of the blast furnace operation as residue from coke used in the operation to reduce iron oxide. (R. 210.) Therefore, further refining of the molten pig iron produced by the blast furnace is required to make steel. The purpose of such refining is to lower the carbon, silicon, phosphorus, manganese and sulphur content of the pig iron to desirable levels, preferably without adding any significant amounts of oxygen or nitrogen to the final steel as a result of the refining process. For example, excessive amounts of carbon, phosphorus and nitrogen cause the steel to be too brittle for many purposes. Too much sulphur has the same effect and also tends to cause surface defects in the steel produced. (R. 233-35.) On the other hand, steel with a too low manganese content will not roll or forge properly. (Re. 227-28). In the [4] process of refining pig iron, the elements of carbon, silicon, manganese and phosphorus combine with oxygen to form oxides which go into a slag layer on top of the metal bath or into the air in the form of carbon monoxide and carbon dioxide. Essentially, the problem of steelmaking is to control the refining process so as to remove sufficient amounts of all the impurities, although the various reactions do not necessarily occur at the same time.

The refining of pig iron into steel may be accomplished by any of several processes. The oldest of these, the Bessemer process, was developed in the 1850's and involves blowing air into a molten bath of pig iron from below through tuyeres in the bottom of a converter. The original Bessemer process, which used a so-called acid refractory lined with material containing silica, an acidic oxide, has proved unsatisfactory in several respects. In the first place, phosphorus is not removed, because the basic slag required for phosphorus removal cannot be used with an acid refractory. Thus the acid Bessemer process can only be used to refine pig iron which already contains a sufficiently low phosphorus content. The relative rarity of such pig iron places a serious restriction on the usefulness of the acid Bessemer process. Further, sulphur is not removed in the acid Bessemer process for the same reason. Additionally, the blowing of air into the bath causes an objectionable amount of nitrogen from the air to remain in the steel. Attempts to solve the nitrogen problem in the 1940's by blowing pure oxygen instead of air through the bottom [5] were unsuccessful because the greater heat of chemical reactions caused by pure oxygen immediately resulted in severe refractory damage.

The Thomas process, also known as the basic Bessemer process, was originated in 1879. This process requires the use of a basic lining, which permits the use of a basic slag capable of removing phosphorus and sulphur from the pig iron. However, the process makes steel which is unsatisfactory for many purposes because of an excessive nitrogen content in the steel produced. In the Thomas process, a so-called afterblow is required to remove phosphorus from the metal bath, since almost

no phosphorus is removed during the main blow when the removal of carbon, silicon and manganese takes place. Phosphorus removal requires iron oxide in the slag, but in the Thomas process, insufficient iron oxide forms in the slag to remove phosphorus until the time of the afterblow.

The principal method for refining pig iron into steel since the 1880's has been the open hearth process, which involves heating large quantities of pig iron in a furnace by means of fuel oil blown onto the surface of the bath. The open hearth process successfully removes objectionable amounts of carbon, silicon, phosphorus, manganese and sulphur from the pig iron without at the same time injecting excessive nitrogen or oxygen into the steel produced. In 1953, approximately 89% of the steel produced in the United States came from open hearth furnaces. (R. 5890.) Although the steel produced by the open hearth process is of excellent quality, the process has the disadvantages of high capital and operating costs as well as a relatively slow rate of production, an average heating requiring [6] eight to ten hours (R. 276-276-A) as compared to a blow of roughly eighteen minutes in a Thomas operation. (R. 246.)

Another process which has been used in the last sixty years for steelmaking is the electric furnace, which makes use of an arc between electrodes to heat the metal charge. The electric furnace process is generally not used for low carbon steel because of the high cost of this type of operation. The process has been used primarily for making specialty steels.

It should be noted that various attempts were made from the 1880's on to make steel successfully by blow-

ing air from above onto the surface of a bath of molten pig iron, usually from tuyeres located in the converter wall above the surface of the bath. The work of Robert, Deemer and Brassert was significant in this regard (DX 61), but there is no evidence that such attempts led to any practical results in commercial steelmaking.

In 1928, the invention of the Linde-Fraenkl process of producing pure oxygen cheaply in large tonnage quantities created the possibility of the use of pure oxygen in the commercial refining of pig iron into steel. (R. 5068.) Starting in the 1930's, at least limited experimentation was carried on in Europe by men including Herman Brassert, Dr. Carl Schwarz and Dr. Robert Durrer using oxygen in the refinement of steel. (R. 5074, 5084, 5085.) Such experimentation led to the application by Schwarz in 1939 for a German patent on a new process of blowing oxygen from above a bath of molten pig iron deeply into the bath "in the manner of a solid body." (DX 61, Schwarz.) The patent was issued in 1943, but there is no evidence that Schwarz' work led to any practical results in commercial operations. (R. 5085.) In the 1940's, especially after World War II, [7] pure oxygen apparently became more readily available at low cost, and experimentation with oxygen in steelmaking increased in intensity. In 1946, a Belgian patent was issued to John Miles on a process involving blowing oxygen from above into a bath of molten pig iron, preferably at an angle between 35% to 70%, so as to agitate the bath by the oxygen jet. (DX 61, Miles.) Again, there is no evidence that Miles's work led to practical results in commercial operations (R. 5085), and in fact there is admittedly no evidence that steel with satisfactory phosphorus and sulphur

content was made commercially by anyone in the 1940's using a pure oxygen blowing process (R. 13, 484-86), despite extensive experimentation by a number of men in several countries of Europe. Such experimentation included a series of tests conducted in Gerlafingen, Switzerland, by Dr. Durrer and Dr. Heinrich Hellbruegge in 1948 and the spring of 1949, blowing pure oxygen downward into a bath of molten pig iron, using an afterblow to remove phosphorus after carbon had been removed in the main blow. (DX 61; R. 4915.) These tests produced steel satisfactory for some purposes, despite apparent refractory damage and an objectionably high phosphorus content in the steel produced. (R. 11,929.)

B. The Tests at Linz and Their Results

Drs. Suess and Trenkler, employees of plaintiff VOEST in Linz, Austria, learned of the work at Gerlafingen, and Dr. Trenkler visited Gerlafingen in May of 1949 to find out more about the tests and their degree of success. VOEST at this time was contemplating reconstruction and expansion of steelmaking facilities damaged in World War II (R. 2222), and was therefore naturally interested in using successful new methods of steelmaking which [8] would not require the high capital expenditures necessary for construction of open hearth operations.

In June of 1949, Drs. Suess, Trenkler, Hauttmann and Rinesch began their own tests at Linz using oxygen in a converter, initially following the instructions of Drs. Durrer and Hellbruegge to blow vertically from above deeply into the bath. (R. 2659-60; DX 11B). The re-

sults in terms of phosphorus removal and refractory damage were initially worse than those achieved at Gerlafingen. However, in further June tests in which the impact pressure of the oxygen jet against the bath surface was reduced by a change in nozzle and an increase in lance height, the results showed satisfactory phosphorus removal without even the need for an afterblow, and also an absence of refractory damage. (See *infra* II. C (3).) Thus a satisfactory oxygen blowing process was achieved for the first time in June, 1949. Tests continued well into 1950 on a larger scale as preparation for commercial operations, which were put into production at Linz in November of 1952. (PX 342, p. 12.) The VOEST plant at Linz was the first commercial operation using the vertical oxygen blowing process perfected in the earlier Linz tests.

According to plaintiffs, more than 75% of all new steelmaking facilities constructed since 1954, or now in the planning stage, use the Linz process. (PX 342, p. 13.) Sixteen steel companies in the United States alone have either begun or planned facilities using the oxygen blowing process. (PX 104, p. 3.)[1] [9] In other parts of the world, sixty-four companies in twenty-three countries have installed the new oxygen steelmaking process or are now doing so. (PX 104.)

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1. Acme Steel Co.
Allegheny Ludlum Steel Corp.
Armco Steel Corp.
Bethlehem Steel Co.
Colorado Fuel & Iron Corp.
Ford Motor Co.
Great Lakes Steel Corp.
Inland Steel Co.
Jones & Laughlin Steel Corp.
Kaiser Steel Corp.
McLouth Steel Corp.
Pittsburgh Steel Co.
Republic Steel Corp.
United States Steel Corp.
Wheeling Steel Corp.
Wisconsin Steel Div. of International Harvester Co.

C. The History of the U. S. Patent Application

Dr. Suess, one of the VOEST employees responsible for the successful tests at Linz, filed patent applications with the Austrian Patent Office as early as January 31, 1950. (PX 2C.) He subsequently filed patent applications in his own name in other countries throughout the world. The original U. S. patent application was filed by Dr. Suess alone on January 16, 1951. (PX 2B.)

The original U. S. application contained 12 claims, directed to a ratio of bath depth to surface area favorable to circulation as the gist of the invention. These claims were four times rejected by the Patent Office, and the original application was finally abandoned in June of 1956 by failure to file a brief with the Board of Appeals in opposition to the Patent Office rejections.

Meanwhile, litigation between Dr. Suess and VOEST in Austria and Germany over the ownership of patent rights for the Linz process had been settled in October, 1955, with the result that VOEST became the owner of Dr. Suess' rights in the United States application and also his other applications and patents throughout the world. (DX 93B, p. 68; PX 3C.)

On November 16, 1955, a continuation-in-part application was filed by Dr. Suess in the United States Patent Office, containing a more detailed specification than the original application and also 15 new claims, the first four of which were directed [10] to the avoidance of deep penetration of the bath by the oxygen stream as the gist of the invention. (PX 2A.) All the new claims were rejected by the Patent Office on June 14, 1956, as unpatentable over prior art.

On December 7, 1956, in response to the Patent Office rejection of claims, the first ten claims were cancelled and the remaining five claims were resubmitted along with a new claim. On June 11, 1957, the pending six claims were cancelled by the applicant without waiting for Patent Office action, and two new claims were submitted. In May of 1956, after the death of Dr. Suess on March 4, 1956, Drs. Hauttmann, Trenkler and Rinesch had requested to be and were joined as inventors in the United States applications. Two of these men, Drs. Rinesch and Hauttmann, filed affidavits with the Patent Office on June 11, 1957, in support of the two new claims filed at the same time. No amendments to the specification were made at this time. The letter accompanying the new claims and the affidavits stated: "The new claims are presented in view of information recently made available and which indicates that the instant application discloses a fundamentally different approach to the refining of pig iron or crude iron by means of substantially pure oxygen than was suggested heretofore." (PX 2A, p. 74.)

A single amendment was made on June 18, 1957, to one of the new claims following a conference with the Patent Office Examiner. The patent application was allowed on June 27, 1957, roughly six and one half years after the original application had been filed, and only 16 days after the two new claims were filed. The patent was issued July 23, 1957.

[11] D. The Patent in Suit (Suess, et al., No. 2,800,631) (PX 1)

The general subject matter of the patent in suit is described at col. 3, lines 16 to 27 of the specification:

> "The process of the invention generally comprises refining the molten metal in a converter type or other suitable vessel with a high purity oxygen jet impinging vertically or approximately vertically on the melt surface substantially at the central portion thereof by means of a blast nozzle or other suitable jet producing means under controlled conditions, hereinafter defined, to supply to the molten metal the required amount of oxygen for completion of refining within a predetermined time, and to produce autogenous heat sufficient to insure completion of the refining and adequate temperature in the refined charge for subsequent handling."

The specification then discusses general features of the process and gives a range of operating conditions at col. 3, line 37, to col. 4, line 5:

> "According to the process of the invention, the high purity oxygen jet is blown vertically, or approximately vertically upon the central portion of the surface of a bath of the molten metal, the jet having a diameter and static pressure at the point of origin, that is, at the blast nozzle or other jet producing means, and the point of origin (blast nozzle) being spaced from the bath surface, such that direct contact of the oxygen jet and the molten metal is established and maintained throughout the refining period without deep penetration of the

molten metal bath by the jet. In so operating, the area of jet impingement is controlled to produce a relatively confined zone of direct oxygen to molten metal contact with respect to the total surface area of the bath. It has been determined in application of the present invention to the refining of predominately molten pig iron charges by means of high purity oxygen, that the jet blown onto the surface of the molten iron, as above described, under a relatively low static pressure at the point of origin, for example, at the overhung blast nozzle, of from 5 to 25 atmospheres (about 75 to 375 pounds per square inch), preferably at about 8 to 12 atmospheres (about 115-175 pounds per square inch), with the jet diameter at the point of origin or blast nozzle being about 1 millimeter (1/25 inch) per ton of charge, and with the point of origin or blast nozzle spaced from the bath surface from at least 150 millimeters (about 6 inches) up to about [12] 2000 millimeters (about 80 inches), produces a sufficiently high reaction velocity of the oxygen with the bath constituents to insure the development of autogenous heat at a rate sufficient to provide the heat required for completion of the refining in a minimum of time, consistent with controlled temperature and control and development of other necessary and required process conditions, such as fluid slag, avoidance of over-oxidation (undue loss of iron to the slag), and avoidance of slopping. The process conducted under these conditions avoids a deep penetration of the oxygen gas into the molten bath which seriously impairs refractory life at the bottom of the refining vessel. In addi-

tion, the impingement area of the high purity oxygen on the central portion of the bath isolates the refractory walls of the refining vessel from the extremely high temperatures which are developed by the direct reaction of the oxygen and the molten metal."

The specification discusses the movement of the bath during the major part of the blow at col. 4, line 26, to col. 5, line 5:

"Although it is not intended to limit the present invention to any specific theory of action or mechanism, it is believed that application of the oxygen jet substantially vertically or approximately vertically upon the central portion of the bath surface brings about a flow in the molten metal from the center of the surface of the bath downwardly and then along the bottom of the refining vessel, and upwardly at the sides of the vessel to the surface of the bath, so that portions of the unrefined metal are continuously presented to a localized center of direct oxygen reaction with the bath metal, while reacted or oxidized portions of the bath move away from this reaction center. This apparent circulation of the molten material is facilitated by shaping of the bottom of the device in its refractory lining in a uniformly curved design, preferably hemispherical or similar shape, so as to offer the minimum of resistance to the circulation.

"Due to the very high affinity of oxygen for iron, initial contact of the high purity oxygen jet with the molten metal bath causes a rapid combination of oxygen and iron to form FeO in the confined

central reaction zone. This is demonstrated by ignition of the oxygen and the propagation of a visible flame within the first minute of blowing. [13] This reaction, together with oxidation of impurity elements, such as silicon and manganese, develops extremely high temperatures in the zone of direct oxygen contact with the molten metal which approach the boiling point of iron, as demonstrated by the evolution of a fume containing iron oxide and manganese oxide. A portion of the iron oxide goes to the slag with the other oxidized elements and a portion diffuses into the bath under the influence of the bath circulation, so that within the first three minutes of the blowing vigorous carbon combustion is initiated due to the high temperatures developed by these reactions. The ensuing reaction of carbon with the FeO and directly with the oxygen gas in the confined direct oxidation zone causes rapid formation of carbon monoxide and the formation of this CO causes a strong boil or agitation of the bath, which augments the bath circulation to continuously present unrefined metal to the oxygen gas reaction zone and to create a slag-metal emulsion. The oxygen jet thus contacts the emulsion of bath and slag components which presents a larger reaction surface and causes the refining reactions to progress rapidly although the oxygen jet does not penetrate deeply into the molten metal bath and is confined to an impingement area at the central portion of the bath surface. This vigorous boiling action is opposed by the pressure of the oxygen jet only in the area of impingement, and outside of this area it represents primarily endo-

thermic reduction of FeO by carbon to form the evolved carbon monoxide, which reaction thus effectively encompasses the zone of direct oxygen reaction at which the highest temperatures prevail affording a maximum measure of protection to the refractory lining of the refining vessel."

The specification also teaches that an early fluid slag is obtained which promotes satisfactory removal of phosphorus and other impurities. Specifically, the patent states at col. 5, lines 60 to 72; col. 6, lines 5 to 25:

"As above mentioned, it is a characteristic of the process of the invention that in the confined zone of direct oxygen reaction at the surface of the molten metal bath, the oxidation products of the impurities in the pig iron, such as silicon and manganese, as well as the oxidized iron form an early fluid slag which is always very rich in oxides, that is, highly oxidizing. With the formation of the slag-metal emulsion, the iron oxide reacts with the [14] carbon present in the bath, primarily outside of the direct oxygen-metal reaction zone, and since such slag-metal reactions are endothermic, the molten bath is maintained cooler in the vicinity of the walls of the refining vessel or converter. * * *

"This formation of an early highly oxidizing fluid slag is of particular value in basic refining when the process is applied to pig iron of analyses used in ordinary open-hearth practice, which would not be amenable to refining by either the acid Bessemer process due to the phosphorus content, or the basic Thomas process due to the lack of sufficient

phosphorus. With the rapid heating of the slag cover and metal bath, the proper amounts of lime or lime supplying substance, such as limestone, may be added at the beginning of the blow and during the blow to insure formation and maintenance of a slag of sufficient basicity. Thus, the early fluid, basic and highly oxidizing slag formed provides an accelerated rate of phosphorus and sulfur removal from the bath, leaving the finished steel very low in both elements. With normal open-hearth pig irons having phosphorus contents ranging from about 0.1-0.35%, and even higher, e.g., 0.85% P, and with correct lime additions, final phosphorus contents not higher than about 0.025% and as low as 0.010% are obtained by the time the carbon end point is reached with only a single slagging operation."

With reference to conditions prevailing near the end of the blow, the specification states at col. 6, lines 62 to 74:

"The vigorous boil, above mentioned, continues up to the carbon end point, and together with the induced circulation of the bath metal toward and away from the central zone of direct oxygen reaction, effectively counteracts any tendency to overoxidation of the bath. When the flame dies and carbon combustion is completed, the bath becomes relatively quiet and intimate contact between slag and metal bath ceases. The turbulence of the bath and slag due to the oxygen stream impinging from directly above is insufficient to cause continuance of oxygen-metal reactions. As a result, steels blown by the process of the invention do not

suffer from the deteriorating effects of high oxygen (FeO) contents."

The specification then gives specific details of an [15] exemplary commercial practice of the process, admittedly (Defendant's main brief, pp. 156, 170) based on experience at the VOEST plant in Linz, Austria, at col. 8, line 72, to col. 9, line 24:

"In actual practice, based on experience in operation of 30 ton converters, oxygen feed rates may be maintained such that depending upon pig iron analysis, amount of scrap addition and desired finished steel analysis, the refining to usual carbon end points on the order of 0.05% C is completed in from about 15 to about 30 minutes, preferably 18 to 22 minutes. Flow rates of from about 4000 to 8000 cubic meters of oxygen per hour are representative of the oxygen input under these conditions.

"In such exemplary commercial practice with 30 ton converters charged to 35 to 36 tons, oxygen pressures at the blast nozzle of about 8 to 10 atmospheres and oxygen jet or blast nozzle diameters of from 27.5 to 35 millimeters (1.1 to 1.4 inches) with nozzle spacings varying from 25 to 50 inches (about 650 to 1250 millimeters have been used, the preferred spacing being from 30 to 40 inches (about 750 to 1000 millimeters). In general, it may be stated that as the oxygen pressure and nozzle diameter are increased, the nozzle spacing is also increased, for example, as the capacity of the refining vessel and total charge is increased. Under these conditions, deep penetration of the molten

metal bath is avoided, while the necessary displacement of the slag cover to maintain direct oxygen to molten metal contact is insured. However, in the unusual circumstances of an abnormally stiff slag cover, the blow may be initiated using mechanical means for penetrating the slag cover to establish oxygen to metal contact."

The specification continues with typical illustrations in col. 9 of the chemical composition of steels produced from various types of pig iron according to the process of the specification; also in col. 10 with "a detailed description of a typical operation of the process."

The patent concludes with two claims reading as follows [16] at col. 12, lines 10 to 33:

"1. Method of refining molten impure iron in the presence of a slag in a vessel having a refractory lining by blowing with oxygen, which comprises discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath at the central portion thereof, to an extent to avoid material agitation of the bath by the oxygen stream, the contact of the oxygen with the bath resulting in reaction of the oxygen with a portion of the iron and with the oxidizable impurities of the bath in a localized reaction zone spaced a substantial distance from the refractory lining, the reactions in said zone resulting in refining of the iron and gas evolution and in the production of high temperature in the reaction zone away from the refractory lining, said reaction producing a circulatory movement in the molten metal, which circulatory movement brings those portions of the

molten metal bath which are remote from the reaction zone into the reaction zone whereby those portions are subjected to said reaction with minimum injury to the refractory lining.

"2. The gaseous oxygen process set forth in claim 1 in which the oxygen is blown into said vessel under pressure in a range between five and about twenty-five atmospheres above normal atmospheric pressure."

E. The Licensing Structure of the Patent in Suit

In the early 1950's, VOEST and several other European steel companies were concerned with the use of oxygen in steelmaking and held or sought patents on various inventions relating thereto. According to plaintiffs:

> "In order to resolve any conflicting claims which might have arisen as between VOEST and OAM, on the one hand, and the Brassert group, on the other hand, and in order to achieve the best and widest possible utilization of the various inventions relating to this new process throughout the world, the exploiting firm of BOT was formed."
>
> (Plaintiffs' main brief, p. 446.)

On May 9, 1952, VOEST and Oesterreichisch-Alpine Montagesellschaft (OAM) [17] another Austrian steel company, entered into an agreement with BOT under which BOT was to have the exclusive right to exploit commercially the various inventions owned by the parties. (PX 4B.) Thus BOT obtained the right to exploit any patents VOEST might acquire on the oxygen blowing process developed at Linz in 1949. BOT also ac-

quired exclusive licensing rights in the Schwarz, Miles and Mannesmann patents in 1952. (PX 9B, 9I and 9E.) In effect, BOT became the exclusive licensing agent all over the world for a so-called pool of patent rights relating to the use of oxygen in steelmaking.

On May 20, 1954, BOT and Kaiser entered into an agreement by which Kaiser became, in effect, the exclusive licensing agent for BOT in the United States, with the right to sue for patent infringement. (PX 5B.) Pursuant to this agreement, Kaiser has since given package license agreements to a number of steelmakers in this country. (PX 7B, 7C, 7D, 7E, 7K, 7M, 92-3.)

Thus, when the patent in suit was granted to VOEST in 1957, BOT and therefore Kaiser acquired the exclusive right to grant licenses under the patent in the United States, and to sue for infringement as in the instant case.

F. The History of Defendant's Operations

In 1953, defendant McLouth desired to expand its steelmaking facilities and was, therefore, receptive to new methods which might produce steel of the desired high quality at lower cost than open hearth operations. McLouth learned of the new process being used at Linz, and therefore sent one of its officers, Mr. Lindberg, to Linz to observe the new process. McLouth also got further information about the Linz process from Kaiser, [18] and on November 12, 1954, McLouth and Kaiser entered into an agreement for Kaiser to give know-how engineering knowledge and consultation services concerning the process to McLouth at a cost of $100,000. (PX 37K.) As a result, McLouth, without further ex-

perimentation of its own (R. 3507), constructed its OP-1 steelmaking shop consisting of three vessels or converters, the design of the operation being copied from the one at Linz. (R. 1283-88, 3513-16, 3525-29, 3540-41, 3573-80, 3447-51, 3490-91, 3507-08.) The OP-1 shop commenced commercial operations on December 19, 1954. In 1955, Dr. Rinesch, later a patentee of the patent in suit, visited the McLouth operation at Trenton and gave constructive advice as to the workings of the operation.

McLouth's decision "to integrate the Austrian process into its steelmaking operations" (PX 98D) resulted in substantial savings and improvements in production. In the OP-1 operation, capital costs of construction were estimated to be $10.00 per annual ton (R. 3458-63), as compared with capital costs of $30.00 to $45.00 per annual ton for an open hearth shop in 1953 (R. 3459), and operating cost savings on the OP-1 shop were about $3.00 per ton. (PX 98D.) Further, Mr. Lyle J. Johnson, McLouth's Vice-President of Engineering, testified that in 1953 the average production per hour in the OP-1 shop was 60 to 65 tons (R. 3468-69), as compared with an average production of 21 to 25 tons per hour in an open hearth operation. (R. 3467-68.) McLouth admits that, by the oxygen process, steel is made "in one-fourth the usual open hearth time." (PX 98C.)

McLouth interpreted the know-how agreement with Kaiser as a license to use the Linz process. However, Kaiser interpreted the agreement as giving McLouth merely an option to take [19] a license, and therefore eventually brought suit against McLouth for patent in-

fringement on July 19, 1957, four days before the patent in suit was issued. On August 29, 1958, the complaint was amended to allege infringement of the patent in suit.

McLouth continued to manufacture steel successfully in the OP-1 shop, and also expanded its operations with the construction of two vessels in another shop, known as OP-2, in 1958, and adding a third vessel to th OP-2 shop in 1960.

The issue whether the know-how agreement of November, 1954, constituted a license agreement or merely an option to take a license was raised by cross motions for summary judgment, resolved by this Court in favor of Kaiser. 175 F. Supp. 743 (D.C. Mich. 1959.) The Court's holding was affirmed on an interlocutory appeal by an opinion of the Sixth Circuit Court of Appeals, dated March 28, 1960 (277 F. 2d 458). The appellate court's affirmance that the November, 1954, agreement did not give McLouth a license under the patent in suit set the stage for a trial on infringement of the Suess, et al. patent. Naturally, the interlocutory appeal necessitated some delay in bringing the suit for infringement to trial.

G. The Issues in This Case

McLouth has raised the standard defenses in a patent case of invalidity and noninfringement. More specifically, with regard to validity, McLouth has contended that the patent in suit is anticipated by prior art, in particular, the Schwarz and Miles patents; also that the process of the patent was obvious to a person skilled in the art at the time the invention was made;

and, further, that plaintiffs did not themselves invent [20] the process, having learned the process from Dr. Durrer and Dr. Hellbruegge of Gerlafingen, Switzerland. McLouth further contends that neither the specification nor claims of the patent comply with the requirements of 35 U.S.C. § 112 relating to definiteness. Defendant denies infringing the process as stated in the claims of the patent, although it does not contest the allegation that it is using the process disclosed by the specification.[2] The basis for this position is McLouth's contention that the claims are not supported by the specification.

Additionally, McLouth asserts that the patent is unenforceable because of an alleged antitrust violation and consequent patent misuse arising out of the licensing structure and practices of the so-called patent pool controlled by plaintiff BOT. In essence, defendant contends

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2. Defendant admits that the process disclosed in the specification of the Suess patent in suit is the same as the process in use at the VOEST plant in Linz, Austria. (Defendant's main brief, pp. 156, 170; reply brief, pp. 12-13.) Defendant further admits that the Linz process is essentially the same as the process in use at the McLouth plant in Trenton, Michigan. (See R. 126; PX 98D.) For example, on final argument, counsel for defendant stated: "We do not contest that basically, fundamentally, the Linz process, as practiced, and the McLouth process — and I may add every other oxygen blowing process of which we have any knowledge — follows the same general method." (R. 13,487; see also R. 13,819.) and in its reply brief, defendant stated: "McLouth has never contested the fact that all oxygen blowing of a practical or commercial nature — and the 'exemplary commercial practice' of the patent is understood to be the Linz practice—is basically similar." (pp. 12-13.)

that the accumulation of a large number of patents in the hands of plaintiffs, Kaiser in the United States, and BOT in Europe and the rest of the world, partly as the result of grant-back provisions in licenses by plaintiffs, constitutes an antitrust violation.

[21] II. THE QUESTION OF VALIDITY

With respect to validity, it must first be noted that according to 35 U.S.C. § 282: "A patent shall be presumed valid. . . . The burden of establishing invalidity of a patent or any claim thereof shall rest on the party asserting it." Thus the burden of proof is upon McLouth in this case to establish the invalidity of the Suess patent in suit No. 2,800,631. In this connection, the Sixth Circuit Court of Appeals has commented on the weight of such a burden as follows: " . . . one otherwise an infringer who assails the validity of a patent fair upon its face bears a heavy burden of persuasion, and fails unless his evidence has more than a dubious preponderance." *Williams Mfg. Co. v. United Shoe Mach. Corp.*, 121 F. 2d 273, 277 (CA 6, 1941), quoting from *Radio Corporation of America v. Radio Engineering Laboratories, Inc.*, 293 U. S. 1, 8 (1934).

A. Anticipation

35 U.S.C. § 102 provides in pertinent part:

"A person shall be entitled to a patent unless—

(a) the invention was . . . patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent, or

(b) the invention was patented or described in a printed publication in this or a foreign

> country . . . more than one year prior to the date of the application for patent in the United States, . . ."

According to the pretrial order in this case, McLouth relies on three foreign patents as anticipation of the patent in suit or as showing the state of the art: the Schwarz German patent No. 735,196 dated July 3, 1943; the Miles Belgian patent No. 468,316 dated March 1, 1947; and the Potts British patent No. 623,881 dated May 24, 1949. However, in the opening statement and also [22] in the final briefs and arguments, McLouth relied only on the Schwarz and Miles patents as pertinent prior art, ignoring the Potts patent almost entirely. (R. 143-44; defendant's main brief, p. 212; reply brief, p. 27). For example, when asked by the court on final arguments: "Do you concede that the Schwarz and Miles patent would be the most pertinent prior art?", counsel for defendant replied: "Certainly the most pertinent patents, yes, your Honor, very much. They are the ones on which we primarily rely. There is a lot of other prior art, to some of which peripheral attention was given and which is interesting from one point or another; but these are the two patents upon which so far as the patented art is concerned McLouth relies." (R. 13,707.) Therefore, the first issue before the court on validity is primarily whether the patent in suit was anticipated by the Schwarz or the Miles patent.

With regard to what must be proven to establish anticipation by prior art as a defense under § 102, the law is clear. Initially, it must be noted that further statutory language in § 103 makes clear that an invention must be "identically disclosed or described" in a

prior art reference for the defense of anticipation to arise under § 102. Further: "In order to anticipate an invention, it is necessary that all of the elements of the invention or their equivalents be found in one single description or structure, where they do substantially the same work in substantially the same way." *Aluminum Co. of America v. Sperry Products, Inc.*, 285 F. 2d 911, 917 (CA 6, 1960). Even more significantly in this particular case: " 'A foreign patent is to be measured as anticipatory, not by what might have been [23] made out of it, but by what is clearly and definitely expressed in it. An American patent is not anticipated by a prior foreign patent, unless the latter exhibits the invention in such full, clear, and exact terms as to enable any person skilled in the art to practice it without the necessity of making experiments.' " *Aluminum Co. of America v. Sperry Products, Inc., supra,* at 922. Accord, *Allied Wheel Products v. Rude,* 206 F. 2d 752, 759 (CA 6, 1953).

Thus the issue of anticipation before the court, precisely stated, is whether McLouth has carried its heavy burden of showing that either of the Schwarz or Miles foreign patents alone identically disclosed the invention of the patent in suit in such full, clear and exact terms as to enable persons skilled in the art to practice the invention without making any further experiments.

(1) THE SCHWARZ PATENT

The Schwarz German patent (DX 61, Schwarz) teaches and claims a process of refining pig iron into steel by directing a jet of oxygen-enriched air or pure oxygen "onto the surface of the bath with such a high kinetic energy that it is capable of penetrating in the manner of a solid body deep into the bath by the use of

extremely high velocities lying preferably above the speed of sound." (DX 61, Schwarz, p. 2.) The teachings of the patent are stated in general language, and the patent does not teach specific operating conditions, such as an acceptable range of oxygen blowing pressures, flow rates, lance heights, bath depths and widths or nozzle diameters. Neither does the patent specify whether the oxygen jet is to be directed vertically downward against the bath or at an angle less than a right angle. [24] No exemplary conditions are given.

According to Dr. John Chipman, a professor emeritus of metallurgy and former head of the department of metallurgy at Massachusetts Institute of Technology, who testified for plaintiffs, the Schwarz patent does not teach a practical operating process. (R. 1019.) Defendant McLouth argues to the contrary, relying on testimony of Dr. Richard A. Flinn, a professor of metallurgical engineering at the University of Michigan, who testified for defendant. However, Dr. Flinn admitted that the Schwarz patent, unlike the patent in suit, does not teach specific operating conditions. (R. 8158-60, 8184-88.) Dr. Flinn also testified that the Suess patent in suit does not teach a practical operating process, except for the exemplary condition, because insufficient directions are given in the specification as to the proper operating conditions for heats of larger or smaller size than the 35 ton exemplary heat. (R. 7885.) Clearly, if Dr. Flinn thought that the patent in suit was too indefinite, although it contains far more specific and detailed information about operating conditions than the Schwarz patent, he could not have seriously contended that the Schwarz patent was sufficiently definite to teach

a practical operating process or to anticipate the patent in suit.

According to Dr. Durrer, a pioneer experimenter with oxygen in steelmaking, who testified at the trial, Schwarz' work never led to any practical results for commercial steelmaking. (R. 5085.) There is no evidence in the record to the contrary. Defendant relies on the fact that the Mannesmann Company in Germany took a license under the Schwarz patent in 1952, but there is no evidence that Mannesmann ever made satisfactory steel on the basis of Schwarz' teachings. Dr. Durrer [25] also testified that the Schwarz patent contained his own ideas (R. 5101; PX 301-A), yet Dr. Durrer himself required further experimentation with oxygen blowing in Gerlafingen, Switzerland in 1948 and 1949, and even with such experimentation, he did not make steel comparable to that made in Linz by the patentees starting in June of 1949. (See *infra,* II, c. (3).) The patentees tried to follow the teachings of Schwarz and Durrer in a series of tests starting June 17, 1949, but failed to get good results, requiring further experiment in a series of tests starting June 25, 1949, to get satisfactory phosphorus removal without refractory damage. (See *infra,* II, c. (3).) In this connection, the recent statement of the United States Supreme Court in *United States v. Adams,* 383 U. S. 39, 50 (1966), that an inoperable prior art reference does not negative novelty, is applicable.

There is also considerable evidence in the record that the teachings of the Schwarz patent cannot, in fact, lead to good results in steelmaking because the early fluid slag required for satisfactory phosphorus

removal according to the specification of the Suess patent in suit is not achieved with deep penetration of the bath by the jet, as taught by Schwarz. As Dr. John Elliott, a professor of metallurgy at the Massachusetts Institute of Technology, a witness for plaintiffs, testified at R. 6170:

"Q. And what effect does the deep penetration of the oxygen jet have on the slag that prevents this adequate control of phosphorus and sulphur that you were referring to?

"A. If the oxygen enters deeply into the bath, there is too little oxygen available where the slag is formed and this prevents the slag from being fluid, it keeps the iron oxide content low. The operator would say he had a dry slag.

"Q. Is a dry slag good for phosphorus removal?

"A. No. It is neither fluid nor highly oxidizing."

[26] (Also see *infra,* II. C (3).)

Defendant's witnesses admit that a deep penetration of the bath by the jet prevents satisfactory phosphorus removal. Mr. Johnson, for example, testified as follows (R. 3483-85):

"Q. It is true, is it not, Mr. Johnson, that during at least the early part of the blow and for a substantial portion of the blow, it is necessary to operate with the lance in what would be termed a high position in order to enable you to get rid of the phosphorus?

"A. To be more specific, it is necessary to melt some of the slag from constituents as early as possible, and the higher lance position would assist in doing that.

"Q. You have to have, as you put it, a higher lance position in order to enable you to get a fluid slag early in the operation in order to enable you to adequately get rid of the phosphorus. Is that a fair statement?

"A. We want to melt some of the slag from constituents as soon as possible so that phosphorus reduction can start.

"Q. And the way that you do that is by utilizing a high lance position at the outset?

"*Mr. Groner*: 'High' being used relatively?

"*Mr. Webb*: Yes.

* * *

"Q. As a matter of fact, it is true, is it not, that the reason why you operate at the higher lance level in the earlier portions of the blows in your No. 1 and No. 2 Shops than you do later on in the blow is because you want to get the fluid slag so that you can get the phosphorus removal. Right?

"A. Partly, and also partly because the height of the material in the vessel is higher at that time.

* * *

"Q. Shall we say, then, that that is one factor, but that the principal reason for operating [27] at the higher lance position throughout a substantial portion of the blow, and particularly at the earlier stages of the blow, is that you want to get a fluid slag so that you can get rid of the phosphorus?

"A. The intention in the operation is to start melting some of the slag as soon as possible, yes.

"Q. And for what purpose then?

"A. So that phosphorus reduction will start.

"Q. How long does that phosphorus reduction continue?

"A. Depending on the temperature of the slag, it can continue during the entire heat or stop and start.

"Q. As a matter of fact, it is important that you do get rid of the phosphorus, or as much of it as you can, in your operation because of the fact that your customers require low phosphorus in the steel in order that it will have the properties desired by them?

"A. Yes."

Also, the testimony of Mr. Horsley, McLouth's General Superintendent of the Hot Metals Division, is significant in this regard. Specifically, he testified (R. 6692-93):

"Q. Yes. And during the course of the blow, on occasions the lance height was lowered. What is the reason why that lance is lowered during the course of the blow?

"A. Normally, we will start a blow with an elevated lance position to flux the slag. After the foreman feels the slag is fluxed, he will start lowering his lance, increasing the flow, or one or the other, and that is to achieve penetration of the metal.

* * *

"Q. There are occasions when the lance is raised during the course of the blow. What is the purpose of raising the lance during the course of the blow?

"A. I remember one heat in particular on the days you were there that the lance was raised, [28] and that particular heat, I don't recall the heat number, was due to a dry slag.

"Q. Well, from time to time in the regular operations on other occasions, they do raise the lance, do they not?

"A. It will happen if they need to flux or make their slag a little thinner; and also it will happen on a heat where they stop a blow on a higher carbon, they raise the lance to flux the slag just before they shut off the oxygen.

"Q. And the purpose in that instance is what?

"A. To thin the slag.

"Q. And what does the thinning of the slag do?

"A. Build up the FeO in the slag.

"Q. And for what purpose?

"A. For phos reduction.

"Q. The higher lance positions are necessary during the operation in order to enable you to get a good, thin slag which will enable you to remove the phosphorus?

"*Mr. Groner*: You mean in all operations or the particular ones that he was just refering to where the lance was raised?

"*Mr. Webb*: In all operations.

"A. Mr. Webb, our intent is to start the blow at an elevated lance position in order to build up the

FeO in the slag in order to have a thin slag, then decrease the lance position or lower the lance and increase the flow to penetrate the bath after the slag has been fluxed. It is true you need a fluid slag for phos or sulphur reduction.

"Q. And the way you get that, as I understand your testimony, is by this higher lance position?

"A. That is our method of getting it."

The testimony of Mr. Johnson and Mr. Horsley is consistent with the teaching of the specification at col. 6, lines 5 to 19, concerning the desirability of an early fluid slag for [29] satisfactory phosphorus removal. The specification of the patent in suit also teaches the avoidance of deep penetration, in contradiction to the teachings of the Schwarz patent, and, further, the specification of the patent in suit at col. 3, lines 70-75, associates the avoidance of deep penetration with the fluid slag necessary for satisfactory phosphorus removal. The Schwarz patent teaches nothing about the necessity of a fluid slag for phosphorus removal or its connection with the avoidance of deep penetration. Thus the teachings of the patent in suit are certainly not "identically disclosed or described" by the Schwarz patent.

In view of the unspecific teachings of the Schwarz patent and its lack of detail concerning operating conditions, as well as the apparent inability of steelmakers including Dr. Durrer and the patentees to make satisfactory steel following the ideas of the Schwarz patent, it cannot be said that the Schwarz patent teaches the invention disclosed in the patent in suit in such full,

clear and exact terms as to enable persons skilled in the art to practice the invention without further experiment. Moreover, the Schwarz patent does not teach the invention claimed in the Suess patent. Schwarz teaches nothing about the avoidance of material agitation of the bath by the oxygen stream or a circulation of the bath produced by chemical reactions in a localized reaction zone, as claimed by the patent in suit. The conclusion is therefore, inescapable that the patent in suit is not anticipated by the Schwarz patent under 35 U.S.C. § 102.

(2) THE MILES PATENT

The Miles Belgian patent (DX 61, Miles) teaches a process of blowing fluid containing from 70% to 98% oxygen (DX 61, Miles, p. 2) downwardly into a bath of molten pig iron. [30] preferably at an angle between 30 and 75 degrees (p. 17), so that the major part of the fluid jet penetrates into the bath (p. 3), serving to circulate and agitate the metal and slag. (p. 18.) The gist of the invention appears to be the teaching of blowing upon the surface of the metal at a velocity which is sufficiently high to assure the penetration of almost all the fluid into the bath, so as to react with the oxidizable impurities of the metal and eliminate them. (pp. 2, 20). According to the patent: "The course of the refining can be controlled by varying the inclination of the jet with respect to the surface or by varying the velocity of the gases or their composition." (p. 4.) In a specific example, the Miles patent teaches the use of a nozzle of 0.32 inches inside diameter, operated at an oxygen pressure of 7 or 8 atmospheres and spaced 6 inches above the surface of a molten metal bath, to obtain the desired penetration of the bath by the jet. (p. 3.) The invention of the Miles patent is applied in its specification to the

Bessemer process in various manners; thus, in effect, a variety of steelmaking processes are suggested in the specification. For example, the specification suggests the use of a normal basic Bessemer blow "until the end of the carbon flame period after which the converter is tipped downward, the air feed is cut off and a high speed jet of oxygen and nitrogen in liquid or gaseous state is projected in order to oxidize the remaining impurities." (p. 5.) In another example, the patent states that "It becomes needless to provide the Bessemer with the usual bottom if the high speed jet is injected into the bath of molten metal through one or more tuyeres, the nozzles of which are located a few inches above the surface of the metal bath." (p. 7.)

[31] It cannot be said that the teachings of the Miles patent identically disclose the invention of the Suess patent in suit in such full terms as to enable persons skilled in the art to practice the invention without further experiments.

In the first place, the teachings of the Miles patent are tentative and leave open a number of possibilities, some of which are recommended over others. Certain of the operating conditions of the patent in suit are included within the broad range of possibilities taught by Miles, but are not necessarily recommended by Miles. Thus Miles teaches that "The jet is established at any angle between 15° and 90° with respect to the horizontal, but preferably between 30° and 75°, while the distance from the jet to the metal and/or the slag should be between 1 and 20 inches, preferably between 4 and 12 inches." (p. 17.) In contrast, the patent in suit teaches and claims only vertical blowing, which is not recommended by Miles, and also teaches a range of

nozzle bath distances from 6 to 80 inches, which only partially overlaps the range of distances taught or recommended by Miles. Further, the patent in suit teaches and claims only the use of pure oxygen gas, but Miles teaches the use of an "oxidizing fluid" which may be either liquid or gas and which may contain as much as 30% nitrogen. (p. 2.) Miles appears to recommend the use of liquid rather than gas by stating: "one of the advantages afforded by the use of a liquid instead of a gas for the jet is that the liquid has a greater force of penetration into the metal; if desired, therefore, the projecting tuyere can be maintained at a greater distance from the metal. Another advantage results from the fact that the oxygen-nitrogen [32] mixture is produced in liquid state during normal manufacture and can be transported and stored more economically than a gas." (p. 2.) Miles also apparently recommends a certain percentage of nitrogen in the fluid used. Thus the patent states: " . . . it has been found that it is too costly to employ a fluid containing more than 98% oxygen so that in effecting the present invention, the relation of nitrogen to oxygen in the refining fluid has been kept between 30/70 and 2/98. The preferred percentage of nitrogen is between 5% and 25% . . . " (pp. 4-5.)

In sum, a person skilled in the art would have to depart from the recommendations of the Miles patent in respect to blowing angle, blowing distance, the use of liquid rather than gas and the chemical composition of the oxidizing fluid in order to arrive at the teachings of the patent in suit. Although the patent teachings of vertical blowing pure oxygen gas from a distance of at least six inches are not expressly precluded by the teachings of the Miles patent, a person skilled in the

art, starting with the Miles patent, would certainly require considerable further experiment to arrive at such teachings of the patent in suit in order to practice the invention. The differences already mentioned between the Miles patent and the patent in suit are alone sufficient to dispose of the contention of anticipation by Miles.

In addition, Miles' suggestions of a variety of processes, including examples using more than one jet, would require a person skilled in the art reading the Miles patent to experiment with the various suggestions to determine which, if any, are satisfactory.

[33] Moreover, the Miles patent does not contain certain essential teachings of the patent in suit, and indeed contains teachings inconsistent therewith. For example, Miles teaches that the major part of the jet penetrates into the bath (p. 3), serving to circulate and agitate the metal and slag. (p. 18.) The patent in suit, on the other hand, claims a process which avoids material agitation of the bath by the jet and includes a circulation caused by chemical reactions rather than the action of the jet. Further, the patent in suit teaches the avoidance of a deep penetration into the bath by the oxygen jet (e.g., col. 3, line 74.) In general, the teachings of the Suess patent concerning operating conditions are more specific and detailed than those of Miles. For example, the patent in suit (at col. 3, lines 56-7) teaches a range of blowing pressures from 5 to 25 atmospheres of pressure, but Miles contains no such teaching. Additionally, in col. 10, the patent in suit teaches an exemplary operation in great detail concerning the quantity and composition of pig iron and scrap used and slag material added, blowing pressure and

nozzle diameter, nozzle bath distance, blowing time, oxygen consumption and efficiency, and chemical composition of the steel produced. Miles teaches no such detailed example producing satisfactory steel.

According to Dr. Durrer, Miles' work led to no practical results in steelmaking (R. 5085), and Dr. Chipman testified that the Miles disclosures did not describe a practical operating method for making steel. (R. 1019.) There is no evidence in the record to the contrary. In fact, there is admittedly no evidence in the record that steel of the quality now produced at [34] Linz and at the McLouth plant in Trenton, Michigan, was produced anywhere in the world by an oxygen top blowing process prior to June of 1949. (R. 13,484-86.) Dr. Durrer and Dr. Hellbruegge were familiar with Miles' work, and yet even with further experimentation consisting of more than 100 heats by the spring of 1949, they apparently failed to produce steel comparable in quality to that produced in Linz (See *infra,* II, C (3).) Moreover, the patentees were admittedly familiar with the Miles patent in early June of 1949 (DX 116, p. 2; DX 117, p. 2), but the patentees also required further experimentation to produce satisfactory steel. It is true that heats No. 21 to 24 of the June, 1949, tests at Linz, which produced good steel, used a nozzle diameter, blowing pressure and nozzle bath distance almost identical with the example suggested by the Miles patent. (See DX 116-A.) However, the example of the Miles patent mentioned a jet speed of 1250 feet per second, somewhat faster than the speed of sound. (DX 61, Miles, p. 3.) Such a supersonic speed of the jet would require the use of a so-called Laval nozzle (R. 2863-67), and therefore the fair implication of the teaching of a supersonic jet

speed by Miles is the teaching of the use of a Laval nozzle. The Miles patent also states that lower speeds can be used, but does not expressly approve even subsonic speeds for purposes of the example. The patentees used a normal nozzle rather than a Laval nozzle in their heats 21 to 24, which otherwise followed the teachings of the Miles example. (DX 116-A.) According to the Rinesch affidavit, the use of the normal nozzle resulted in a subsonic jet speed of 280 meters or roughly 919 feet per second (DX 116, p. 4), over 300 feet per second slower than the speed [35] suggested by Miles. This difference in jet speed would materially reduce the impact pressure of the jet and therefore the penetration of the jet into the bath. Such a difference in penetration is consistent with the difference in teaching between the Miles patent and the Suess patent with regard to penetration. Although Miles does not expressly teach "deep penetration", as does Schwarz, it is agreed that Miles' teachings are essentially the same as Schwarz' and that a person following Miles' teachings will obtain a deep penetration of the bath by the jet (e.g., R. 107-08). The patent in suit, on the other hand, teaches the avoidance of deep penetration, and the record indicates that such avoidance of deep penetration is in fact the gist of the invention by the patentees. (See *infra,* II B (2); II E (1).)

In addition to the absence of proof in the record that persons skilled in the art following Miles' teachings were able to make satisfactory steel, there is also the affirmative evidence that deep penetration as taught by Miles cannot in fact lead to good results in steelmaking, because the early fluid slag necessary for adequate phosphorus removal is not formed with a deep penetration

of the bath by the jet, as already discussed in connection with the Schwarz patent.

In short, the Miles patent cannot be said to anticipate the patent in suit for a number of reasons: the patent in suit contains specific and detailed operating conditions and teachings either not found in Miles or not recommended by Miles, or contradicting the teachings of Miles; and, further, the evidence in the record indicates that Miles' teachings did not and indeed could not lead to good results in steelmaking comparable to those achieved by the patentees.

[36] (3) THE POTTS PATENT

Since defendant has apparently withdrawn its reliance on the Potts British patent (DX 61, Potts) as anticipating the patent in suit, a lengthy discussion of this patent is unnecessary. Potts teaches that "The jet is preferably directed onto the surface of the metal at an angle," and that "The jet device is usually placed in the furnace in such manner that the nozzle is approximately at the slag surface or slightly submerged therebelow, although good results have been obtained with the nozzle placed approximately 3 to 6 inches above the slag surface. The oxygen jet, when at a velocity above sonic speed, tends to penetrate the slag and metal and to form a well-defined cavity or recess in the surface of the molten metal." (DX 61, Potts, p. 3.) Clearly the essence of Potts' teaching is inclined blowing at supersonic speed, resulting in a deep penetration of the bath by the jet. Such teaching does not anticipate a teaching of vertical blowing from at least 6 inches above the bath, so as to avoid deep penetration of the bath by the jet. Further, Potts does not teach the range of operating

conditions of the patent in suit, nor is there any evidence that Potts' process led to any practical results in steelmaking.

(4) CONCLUSION

On the issue of anticipation by prior art, defendant's position has shifted several times in the course of this litigation. As already noted, the pretrial order stated as a defense anticipation of the patent in suit by the Schwarz, Miles and Potts patents. On the opening statement, defendant stated a defense of "no invention over Schwarz and Miles," a vaguely [37] worded defense which could include either lack of novelty under § 102 or obviousness under § 103. However, on opening statement, counsel for defendant continued, stating:

> "Mr. Webb adverted yesterday to the fact that we did not claim that Schwarz and Miles blanketed or anticipated the patent in suit. Of course not. They were practical men with a practical method of operation. They taught oxygen blowing as it is practiced. They weren't compelled to resort to the subterfuges of the patent in suit. They didn't have any absurdities about the avoidance of material agitation. So there are differences between the patent in suit and Schwarz and Miles.
>
> "But to the extent that the patent in suit departs from Schwarz and Miles it is pure phoney, non-practiced, non-known, in any commercial operation in the world." (R. 143-44.)

This statement appears to have been a waiver of any defense of anticipation by Schwarz and Miles.

On final arguments, the Court expressed some confusion as to whether defendant was relying on anticipation or obviousness, stating:

> "I don't know for sure—I haven't heard, of course, from the defendants—but after reading the briefs, I got that impression; that their main thrust here is more that this was, in fact, anticipated by Schwarz and Miles and the teachings of Durrer and Hellbruegge, rather than admitting that this is some advance in the art and yet it doesn't arise to the level of invention."

Counsel for defendant then expressed agreement with the Court's statement, so as to give the impression defendant was relying on a defense of anticipation after all. (R. 13,161-2.) This impression was strengthened (R. 13,409) when counsel for defendant stated that plaintiffs' "operation, so far as it is known in commercial exemplification, is simply and solely what was known before them by Schwarz and by Miles." The Court then asked counsel for defendant: "Well, now, in view of that statement, [38] is it your position that the patent in issue is anticipated by Schwarz and Miles?" and counsel answered: "If it please your Honor, we proved defenses under Section 102 and under Section 103."

However, shortly thereafter the following colloquy occurred:

> "[*Counsel for defendant*]: Our defense has been largely built around the defense of Section 103, that no invention is shown in the patent in suit over the prior art. We have done that despite having pleaded that it was anticipated because of the ex-

crescences on the patent that are not duplicated in the prior art.

"*The Court*: Well, now, there is a difference between anticipation and whether there is invention over the prior art.

"[*Counsel*]: Yes, your Honor; I recognize it.

"*The Court*: Now, which do you rely on?

"[*Counsel*]: We rely on section 103, if it please your Honor, that there is no invention.

"*The Court*: The test of invention.

"[*Counsel*]: Yes, sir.

"*The Court*: You are not relying on anticipation, then?

"[*Counsel*]: Not specifically." (R. 13,409-10.)

At R. 13,710, the Court once again asked counsel for defendant: "Do you contend Schwarz and Miles anticipate Suess?" and counsel answered: "No, your Honor, because in the patent in suit there are these erroneous fictitious statements about avoiding deep penetration and that sort of thing, which are just the contrary of Schwarz and Miles. Actually I think it is true that the patent in suit adopted that talk about the avoidance in order to try to keep Schwarz off their neck."

Defendant's briefs after trial are unclear whether anticipation or obviousness is urged as a defense, almost to the [39] point of being deliberately vague. Thus defendant's main brief argues: "Efforts to differentiate the patent from the prior art Schwarz and Miles patents get nowhere because the patent is silent on the

points of asserted difference. The patent in suit is invalid over Schwarz and Miles." (p. 223.) Defendant's reply brief argues: "The patent in suit, stripped of its inaccuracies, and disregarding its unresolvable ambiguities, is undistinguishable from the Schwarz and Miles patents. The patent discloses no invention over Schwarz or Miles and is invalid." (p. 40.)

The Court might justifiably have relied entirely on defendant's statements at R. 143-44, 13,410 and 13,710, waiving any defense of anticipation by prior art. However, in view of defendant's somewhat ambivalent attitude concerning this defense, the Court felt obliged to decide the issue on the evidence. As already discussed, it is the opinion of this Court that defendant has not carried its heavy burden of showing that either the Schwarz or Miles patents alone identically disclosed the invention of the patent in suit in such full, clear and exact terms as to enable persons skilled in the art to practice the invention without further experiment. In other words, the Court finds that the patent in suit is not anticipated by prior art.

B. Nonobviousness

In 1952, Congress enacted Section 103 of 35 U.S.C., which provides:

> "A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made."

[40] By enacting section 103, Congress added a third statutory requirement of 'nonobviousness' to the two requirements of novelty and utility that had been codified as long ago as the Patent Act of 1793. However, a similar requirement of 'invention' had been established by judicial precedent as early as 1850 in the Supreme Court's opinion in *Hotchkiss v. Greenwood,* 11 How. 248, 267 (1850), stating:

". . . unless more ingenuity and skill . . . were required . . . than were possessed by an ordinary mechanic acquainted with the business, there was an absence of that degree of skill and ingenuity which constitute essential elements of every invention."

In the recently decided case of *Graham v. John Deere Co.,* 383 U. S. 1 (1966), the Supreme Court held that Section 103 of the Patent Act was intended to codify the principle of the *Hotchkiss* case, "and that, while the clear language of § 103 places emphasis on an inquiry into obviousness, the general level of innovation necessary to sustain patentability remains the same." (383 U. S. at p. 4.)

It must be noted that in this case, "the time the invention was made" for purposes of section 103 must be considered as the time of the filing date of the first patent application in a foreign country, since under sec-

tions 104 and [41] 119 of 35 U.S.C.[3] a foreign inventor may not establish a date of invention earlier than his first filing date in a foreign country, assuming such date is earlier than the filing date in this country. As the Court stated in *Monaco v. Hoffman,* 189 F. Supp. 474, 481 (D.C. Dist. Col. 1960):

> "Sections 104 and 119 must be read together. They are *in pari materia.* The effect of the two provisions is to accord to a foreign inventor the benefit of the

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3. These sections provide, in pertinent part:

"§ 104. *Invention made abroad*

"In proceedings in the Patent Office and in the courts, an applicant for a patent, or a patentee, may not establish a date of invention by reference to knowledge or use thereof, or other activity with respect thereto, in a foreign country, except as provided in section 119 of this title."

"§ 119. *Benefit of earlier filing date in foreign country; right of priority*

"An application for patent for an invention filed in this country by any person who has, or whose legal representatives or assigns have, previously regularly filed an application for a patent for the same invention in a foreign country which affords similar privileges in the case of applications filed in the United States or to citizens of the United States, shall have the same effect as the same application would have if filed in this country on the date on which the application for patent for the same invention was first filed in such foreign country, if the application in this country is filed within twelve months from the earliest date on which such foreign application was filed; but no patent shall be granted on any application for patent for an invention which had been patented or described in a printed publication in any country more than one year before the date of the actual filing of the application in this country, or which had been in public use or on sale in this country more than one year prior to such filing."

> filing date of his first application in a foreign country, instead of limiting him to his later filing date in the United States. On the other hand, such an inventor may not avail himself of a still earlier date of invention abroad."

[42] Although the patentees now contend that the subject matter of the patent in suit was invented in June of 1949, the "time the invention was made" must be considered as January 31, 1950, the filing date of the first application by Dr. Suess in Austria. (PX 2C.)

It must be noted also that the most pertinent prior art references for purposes of section 103 are, again, the Schwarz and Miles patents. Although the pretrial order also listed the Potts British patent as pertinent prior art, only the Schwarz and Miles patents were discussed in the opening statements, briefs after trial or final arguments as pertinent to the issue of obviousness.

The work of Drs. Durrer and Hellbruegge creates no issue as to the obviousness of the invention by the patentees, since such work does not constitute prior art under section 103. Both the statutory language and legislative history of section 103 made clear that the term "prior art" as used in section 103 refers only to "what was known before as described in section 102." S. Rep. No. 1979, 82d Cong., 2d Sess. (1952) at 6; H. R. Rep. No. 1923, 82d Cong., 2d Sess. (1952) at 7. Prior use in a foreign country is not prior art as set forth in section 102, which section refers, among other things, to inventions "known or used by others" or "in public use or on sale" in this country only, and makes no mention of inventions known, used or sold by others in a foreign country. Furthermore, defendant has admitted that

the work of Dr. Durrer and Dr. Hellbruegge is not a prior use which could invalidate the patent in [43] suit,[4] and that "use in a foreign country is of no legal effect as far as this lawsuit is concerned," (R. 4555-56). Hence, this Court is not faced with the question whether the subject matter of the patent in suit would have been obvious to persons skilled in the art familiar with the work of Dr. Durrer and Dr. Hellbruegge.

Thus the issue under section 103 in this case is whether the subject matter as a whole of the patent in suit would have been obvious to persons skilled in the art of steelmaking familiar with the Schwarz and Miles patents on or about January 31, 1950, the filing date of the Austrian application by Dr. Suess. As already noted, defendant's burden of proof on this issue of validity is a "heavy burden" requiring "more than a dubious preponderance" to satisfy. *Williams v. United Shoe Co.,* 121 F. 2d 273, 277 (CA 6, 1941). To resolve the issue of nonobviousness, the Court feels obliged to consider the differences between the subject matter as a whole of the claims of the patent in suit and the per-

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4. In defendant's main brief, p. 225, it is admitted that ". . . the work of Drs. Durrer and Hellbruegge is not, within the purview of the Patent Law of the United States, a prior use, and they are not prior patentees or prior publishers," and further states: "McLouth relies on the work of these two witnesses for the sole purpose of showing that the patentees of the patent in suit are not inventors. It is understood that when the proofs concerning Dr. Durrer and Dr. Hellbruegge are restricted to this issue, the plaintiffs do not dispute the rule that the patentees must be the true inventors." Also, in defendant's reply brief, pp. 33 and 41, it is admitted that a foreign prior use cannot be used to invalidate a United States patent.

tinent prior art, and also other objective evidence of obviousness or nonobviousness such as commercial success, for example. As the Supreme Court recently stated in the *Graham* [44] case, *supra,* 383 U. S. 1, 17-18 (1966):

> "While the ultimate question of patent validity is one of law, *A. & P. Tea Co. v. Supermarket Corp., supra,* at 155, the § 103 condition, which is but one of three conditions, each of which must be satisfied, lends itself to several basic factual inquiries. Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquiries may have relevancy."

Further, as Judge Learned Hand stated in *Reiner v. I. Leon Co., Inc.,* 285 F. 2d 501, 503-04 (CA 2, 1960):

> "The test laid down is indeed misty enough. It directs us to surmise what was the range of ingenuity of a person 'having ordinary skill' in an 'art' with which we are totally unfamiliar; and we do not see how such a standard can be applied at all except by recourse to the earlier work in the art, and to the general history of the means available

at the time. To judge on our own that this or that new assemblage of old factors was, or was not, 'obvious' is to substitute our ignorance for the acquaintance with the subject of those who were familiar with it. There are indeed some sign posts: e.g. how long did the need exist; how many tried to find the way; how long did the surrounding and accessory arts disclose the means; how immediately was the invention recognized as an answer by those who used the new variant?"

(1) THE PRIOR ART AND THE INVENTION BY THE PATENTEES

As already discussed, the Schwarz German patent and the Miles Belgian patent taught and claimed processes of steelmaking involving blowing oxygen into a bath of molten pig iron from above. Schwarz taught blowing deeply into the bath in the manner of a solid body (DX 61, Schwarz, p. 2) and, although Miles [45] did not expressly teach "deep" penetration, it is conceded by the parties that Miles' teachings involved a deep penetration of the bath by the jet (e.g., R. 108). With regard to the blowing, the angle of the jet in the Schwarz patent is unspecific and the Miles patent recommends blowing at an angle of between 30 and 75 degrees. (DX 61, Miles, p. 17.) The Miles patent teaches that the action of the jet itself agitates and circulates the bath (DX 61, Miles, p. 18), but the Schwarz patent contains no such teaching. Both the Schwarz and Miles patents contain reference to a limited center of chemical reactions in the bath caused by contact of the jet with the bath surface. (DX 61, Schwarz, pp. 4-5; Miles, pp. 3, 15, 16.) Additionally, both the Schwarz and Miles

patents teach that the danger of excessive refractory wear is avoided in their methods of steelmaking because the chemical reactions take place at the center of the bath, away from the refractory lining. (Schwarz, pp. 4-5; Miles, p. 3.) The parties agree that the gist of the teachings of both the Schwarz and Miles patents is the necessity of penetration deep into the bath by the oxygen jet.

As already noted, according to the testimony of Dr. Durrer, the teachings of both the Schwarz and Miles patents led to no practical results in commercial steelmaking. (R. 5085.) The work of the patentees at Linz, Austria, on the other hand, has resulted in a commercially successful process of steelmaking, admittedly adopted by defendant in this case and presently used throughout the world.

If the process perfected at Linz had been obvious to steelmakers familiar with the Schwarz and Miles patents, it is [46] difficult to understand why satisfactory low phosphorus steel would not have been produced earlier than 1949. The Schwarz patent issued in 1943, and the Miles patent in 1947. At this time, there was considerable interest in developing for commercial use new methods of steelmaking involving the use of oxygen. The invention in 1928 of the so-called Linde-Fraenkl process for the production of pure oxygen made feasible the invention of new processes of steelmaking involving the use of pure oxygen. (R. 5068.) Experimentation to this end began as early as the 1930's, resulting, for example, in the Schwarz patent application in 1939. According to Dr. Durrer, numerous men experimented with oxygen refining in the 1930's

and 1940's, but their efforts did not lead to any practical results. (R. 5064-86; 5111-37.) It is disputed at what point in time pure oxygen became available in large quantities for use in commercial production of steel. Defendant contends that oxygen did not become available inexpensively in large quantities until the late 1940's, so as to inhibit the development of a commercial oxygen steelmaking process before that time. Conflicting evidence on the point leaves this Court unable to fix with certainty any date on which oxygen became available inexpensively in large quantities for commercial production of steel. However, in light of the limited experimentation with oxygen in steelmaking as early as the 1930's, the alleged unavailability of oxygen for commercial production before the late 1940's would not necessarily have been an inhibiting factor on experimentation with oxygen in steelmaking. The incentives to find a satisfactory oxygen steelmaking process were substantial, in view of the high capital and operating costs as well as the relatively slow production rates of the open hearth process. Yet there is [47] admittedly no evidence in the record that satisfactory low phosphorus steel was produced even experimentally prior to the June, 1949, tests at Linz, Austria, by the patentees. (R. 13,484-86.) Further it appears from the record that the first successful commercial operation involving an oxygen blowing process of steelmaking was installed at Linz in November, 1952. (PX 342, p. 12; PX 95, p. 783.)

The substantial advantages of the Linz oxygen blowing process of steelmaking quickly became apparent. The quality of the steel produced was com-

parable to open hearth steel, while capital and operating costs were considerably reduced. Therefore, steelmakers from all over the world came to Linz to familiarize themselves with the new Linz process. (PX 342, p. 12.) The reaction of steelmakers to the Linz process was one of initial skepticism followed by recognition of the invention and adoption of the process. Dr. Durrer stated in a memo as early as December 14, 1949, that the work at Linz "contradicts all metallurgical expectations," and "shows a new metallurgy with which we must first of all become acquainted." (DX 89B (20).) Defendant McLouth, which now contends that the process at Linz would have been obvious to steelmakers familiar with the Schwarz and Miles patents, paid $100,000 for know-how relating to the Linz process, but explains this expenditure by claiming unfamiliarity with the prior art at the time. (R. 13,818.) Such explanation is not entirely convincing, in view of McLouth's far ranging search for the most desirable method of steelmaking available, a search which involved a trip to Europe by Mr. Lindberg of McLouth. Defendant, having decided to "integrate the Austrian process into its steelmaking operations" (PX 98D; R. 1118), copied the design of the Linz operation (R. 3490-91), and proceeded to construct its OP-1 [48] shop without further experimentation of its own. (R. 3507.) However, McLouth also spent large sums to construct duplexing equipment for steelmaking in case the Linz process did not prove satisfactory. The duplexing equipment proved unnecessary, and was eventually taken out of service. (R. 3542-44, 1296-1300.) As Mr. Bryn, McLouth's President, testified (R. 1297):

"Q. In other words, even at that time you weren't sure whether by this new process you would be able to produce steel of adequate quality to meet your demands?

"A. That's right.

* * *

"Q. And I gathered from your statement that you were not sure at the time as to whether or not you would be able to get a product comparable with the product of the open hearth process?

"A. That's right. That's the reason we spent the dough to make it possible to duplex or *otherwise we wouldn't have thrown that dough out the window.*" (Emphasis added.)

The remarkable success of the Linz process is dramatically illustrated by the fact that no open hearth furnace has been built in this country since 1953, when knowledge of the Linz process became available in this country. (R. 5922-23.) As already mentioned, more than 75% of all new steelmaking facilities since 1954 or now in the planning stage are Linz process installations (PX 342, p. 13); 16 steel companies in the United States alone have either begun or planned commercial production using the basic oxygen process in use at Linz (PX 104, p. 3); and 64 companies in 23 foreign countries have installed the process. It was estimated at trial that the basic oxygen steelmaking annual capacity in this country as of January 1, 1966, would be roughly 32 million tons. (R. 5871-72.)

[49] In short, there was a striking difference in the results achieved by the process developed and practiced at Linz as compared with the results of the prior art,

and particularly the Schwarz and Miles patents. As recently stated by the Sixth Circuit Court of Appeals in the case of *Simplicity Manufacturing Co. v. Quick Mfg., Inc.*, 355 F. 2d 1012, 1015-16 (1966), the patentee's "ingenuity and resourcefulness brought about a result which the prior art inventors were unable to conceive or anticipate."

There was apparently some confusion even among the patentees themselves as to the true explanation for such difference in result. As Dr. Hauttmann said in his affidavit submitted to the Patent Office (DX 117, p. 3): "While the advantages of the new method were appreciated at once, a completely satisfactory explanation for the improved result was not readily apparent."

Dr. Suess filed patent applications in many countries, including the United States application dated January 16, 1951, claiming the gist of the invention to be the maintenance of a certain proper ratio between the bath depth and surface area. However, in his original Austrian application dated January 31, 1950 (PX 2C), and also in the first four claims of his United States continuation in part application (PX 2A), Dr. Suess claimed the avoidance of deep penetration in the bath by the oxygen as the essence of the invention. Two of the other patentees, Dr. Hauttmann and Dr. Rinesch, apparently also shared this theory, at least in 1957 when they presented affidavits to the Patent Office. The Rinesch affidavit states that the patentees determined in the June, 1949, tests at Linz "that a satisfactory refining operation could be obtained so long as the oxygen jet does not penetrate deeply into the bath." (DX 116, [50] p. 4.) The Hauttmann affidavit considered the in-

vention to be the creation of a limited center of reaction "substantially in the surface layer" resulting in a controlled circulation of the bath. (DX 117, pp. 3-4.) Dr. Hauttmann also expressed his opinion that the limited center of reaction and circulation was brought about by the avoidance of deep penetration. (DX 117, pp. 4-5.) Dr. Trenkler, the other patentee, testified that the only significant difference in practice over prior teachings was a reduction of the impact pressure of the jet and, therefore, a lesser penetration into the bath by the jet than would have resulted from prior teachings. (R. 11,905.) Thus, at one time or another, all four of the patentees expressed their understanding that the avoidance of deep penetration was the basis of a successful oxygen steelmaking process.

(2) THE MEANING OF "THE AVOIDANCE OF DEEP PENETRATION"

Clearly, the phrases "deep penetration" and "avoidance of deep penetration" have no precise meaning. Further, it is apparent that these phrases have been given different meanings by various people since the Schwarz patent first used the phrase "deep penetration" in 1943. As Mr. Justice Holmes once said: "A word is not a crystal, transparent and unchanged; it is the skin of a living thought and may vary greatly in color and content according to the circumstances and the time in which it is used." *Towne, v. Eisner,* 245 U. S. 418, 425 (1918). Thus the word "deep" has received a variety of definitions in regard to penetration of the bath depending on the motives of the person defining the word.

To Schwarz, deep penetration apparently meant penetration of the bath sufficient to avoid a mere surface reaction of [51] the jet. The Schwarz patent states:

"Surface contact is not sufficient in most cases to produce a rapid reaction, such as the blowing of the gas over the surface of the bath or the mere blowing of the gas onto the surface of the bath." (DX 61, Schwarz p. 1.) Dr. Durrer and Dr. Hellbruegge apparently had a similar underdstanding of the term "deep penetration." (See DX 61, Hellbruegge, *Stahl und Eisen* Article, pp. 5, 7.) Demonstration number six at Ann Arbor, Michigan, during the trial of this litigation, established that such a surface reaction is not satisfactory for steelmaking because of a dangerous slopping condition that results, and also the poor quality of the steel produced. For Schwarz, "deep" penetration did not mean sufficient penetration to cause refractory damage. The Schwarz patent states:

> "In the refining of steel with oxygen-enriched air or oxygen, when using the method in accordance with the invention, the danger of rapid wear of the container liner is eliminated since the reaction between oxygen and iron or iron-accompanying substances with the phenomena resulting therefrom, namely local overheating and accumulation of ferrous oxide, takes place in the center of the steel bath and therefore, the walls of the vessel are not substantially attacked." (DX 61, Schwarz, pp. 4-5.)

Miles, also, taught that the penetration of the jet should stay "at a good distance from the refractory lining of the furnace" so as to avoid refractory wear. (DX 61, Miles, p. 3.)

Dr. Suess in his many patent applications mentions the avoidance of deep penetration as desirable. The original Austrian application explains that deep penetration would result "in an undesired reaction of the

slag due to the strong swirling motion and that it would reduce the surface lining considerably." (DX 2C, p. 2.) However, when the Suess application in Germany was faced with opposition by the Schwarz patent, Dr. Suess attempted [52] to distinguish the Schwarz patent as follows:

> "In contradistinction to [Schwarz], in the case of the process of the present invention the molten bath is blown with so little kinetic energy that the oxygen does not penetrate. The movement of the bath is caused solely by chemical reactions on the surface. As soon as they are at an end, no penetration of the oxygen and no movement of the bath take place." (DX 93 B, pp. 31-32.)

Thus, Dr. Suess attempted to distinguish his German application from the Schwarz patent by defining the avoidance of deep penetration as no penetration at all. Similarly, Dr. Rinesch and Dr. Hauttmann were faced with the problem of distinguishing the prior art in prosecuting the United States Patent Application in 1957. The Rinesch affidavit states:

> ". . . our concept of avoiding deep penetration of the molten metal with the oxygen blast is just the opposite of the methods disclosed in the Schwarz and Miles et al. patents . . ." (DX 116, p. 7.)

Dr. Rinesch also said that deep penetration:

> ". . . creates an uncontrollable turbulence in the bath. The oxygen remains dissolved in the bath and the high oxygen content in the final steel leads to hot shortness or requires unsatisfactory quantities of deoxidizers. Furthermore, the phosphorous cannot be slagged off. Moreover, the walls, and par-

ticularly the bottom of the vessel become as hot as the reaction center and, therefore, are eroded severely." (DX 116, p. 6.)

Dr. Hauttmann in his affidavit stated:

". . . our concept of securing purification of the entire contents of the bath mainly by the controlled circulation induced by the reaction center is just the opposite of trying to carry the oxygen to all parts of the bath by agitation produced by deep penetration . . ." (DX 117, p. 5.)

Dr. Hauttmann's affidavit also associates deep penetration of the bath by the oxygen jet "with agitation producing injury to the lining and its consequent interference with the refining [53] action . . ." (DX 117, p. 3.) Thus, both Dr. Rinesch and Dr. Hauttmann contend in their affidavits that the subject matter sought to be patented involved avoidance of the deep penetration taught by Schwarz. However, both Dr. Rinesch and Dr. Hauttmann also define deep penetration with reference to agitation or turbulence of the bath, excessive refractory wear, and poor quality of the steel produced.

The first four original claims of the continuation-in-part application of the patent in suit, which expressly claimed the avoidance of deep penetration, were rejected by the Patent Office along with all other claims submitted at the same time as unpatentable over the prior art Miles patent. In response to this rejection, counsel for the applicants wrote a letter to the Patent Office attempting to distinguish the Miles patent by contending that the applicants' method differed from the Miles method "in emphasizing a much lower impingement

pressure and a practically negligible penetration of the surface of the molten metal by the oxygen jet." (PX 2 A, p. 68.) Clearly, the patentees and their attorneys defined the avoidance of deep penetration as practically no penetration at all in order to distinguish the prior art for purposes of prosecuting their own patent applications.

The specification of the patent in suit refers to the concept of avoidance of deep penetration in four different places (Col. 3, lines 46 and 74; col. 4, line 70; and col. 9, line 18.) Most significantly in column 3, lines 64 to 75, the patent teaches that the process, when conducted under certain specified operating conditions:

> " . . . produces a sufficiently high reaction velocity of the oxygen with the bath constituents [54] to insure the development of autogenous heat at a rate sufficient to provide the heat required for completion of the refining in a minimum of time, consistent with controlled temperature and control and development of other *necessary and required process conditions, such as fluid slag, avoidance of overoxidation (undue loss of iron to the slag), and avoidance of slopping. The process conducted under these conditions avoids a deep penetration of the oxygen gas into the molten bath which seriously impairs refractory life at the bottom of the refining vessel.*" (Emphasis added.)

This important reference in the specification gives a new meaning to the phrase "avoidance of deep penetration" and at the same time discloses a crucial teaching of the patent in suit. According to this reference, the avoidance of deep penetration means a penetration suffi-

cient to avoid a surface reaction and slopping, and yet not deep enough to seriously impair refractory life at the bottom of the vessel, or to prevent the formation of the fluid slag which, according to the patent, is necessary for adequate phosphorus removal.

The claims of the patent in suit do not expressly refer to the concept of deep penetration or its avoidance. However, plaintiffs in this litigation contend that the avoidance of "material agitation of the bath by the oxygen stream" incorporates the idea of avoiding deep penetration. (E.g., plaintiffs' main brief, p. 268.) In the association of deep penetration with "material agitation" of the claims, plaintiffs now urge a broad definition of deep penetration as penetration sufficient to burn the bottom of the refractory. (E.g., plaintiffs' main brief, pp. 274-76.) However, such a definition ignores the further limitation placed on penetration by the specification of the patent in suit with regard to the formation of a fluid slag. [55] As already noted, the specification teaches that when a fluid slag is formed on the surface of the metal, deep penetration within the meaning of the patent is avoided. Thus, if a thick slag rather than a fluid slag is formed during the blowing operation, deep penetration within the meaning of the specification of the patent in suit is not avoided even though there may be no refractory damage.

There has been considerable disagreement as to the numerical degree of penetration taught by the patent in suit. Dr. Hauttmann testified that the process of the patent in suit involved a penetration of not more than one-half of the bath depth. (R. 2530.) Dr. Trenkler testified that penetration from one-third to one-half of

the bath depth would be the maximum penetration under the teachings of the patent in suit. (R. 11,911.) Dr. Elliott said that, in his opinion, "deep penetration arises when the jet enters more than, say, 35 to 40 per cent of the bath depth." (R. 6637.) Mr. Stone, on the other hand, said that he was sure only that a penetration of 90% to 100% of the bath would be deep penetration. (R. 7179.) Defendant's witness, Dr. Flinn, stated that the patent teachings would not enable him to assign any quantitative meaning to the term "deep penetration." (R. 8014-15.)

It must be noted at this point that defendant claims to be practicing deep penetration by blowing from one-third to two-thirds of the bath depth (R. 10,995; Defendant's main brief, p. 130) and, therefore, following the teachings of Schwarz. (R. 13,819.) Defendant also contends that the term "deep penetration" as used in the Suess patent means a "practically negligible penetration." (Defendant's reply brief, p. 98.) Thus, on the [56] one hand, at least one witness for plaintiffs sees the avoidance of deep penetration as any penetration less than 90% of the bath depth, while, on the other hand, defendant sees the avoidance of deep penetration as literal surface blowing without any penetration of the bath at all. (Defendant's reply brief, p. 99.)

(3) NONOBVIOUSNESS OF THE INVENTION

It appears to this Court that penetration of the bath by the jet within the limits taught by the specification of the patent in suit is the reason for the success of the Linz process. Such penetration results in a steelmaking operation that avoids the problems of refractory damage and excessive phosphorus in the finished steel

which had rendered the prior art teachings commercially inoperable. It also appears to this Court that blowing so as to achieve such a limited degree of penetration was unobvious to persons skilled in the art prior to 1950. Indeed, by 1950 there would have been good reason for persons skilled in the art to despair of finding a successful oxygen blowing process for steelmaking in light of the failures of the prior art teachings and the numerous unsuccessful experiments with oxygen blowing conducted during many years prior thereto. On the one hand, a series of patents going back as far as the Robert Patent (DX 61) in 1888 had taught literal surface blowing with only negligible penetration of the bath by a jet or jets and produced no practical results. On the other hand, the processes of the Schwarz, Miles and Potts patents, which taught deep blowing, were also commercially inoperable. Therefore, the entire approach to steelmaking by blowing oxygen from above onto a bath might well have seemed unfruitful in light of the failures of both surface blowing and [57] deep blowing. The success of the patentees appears to have been the result of using an intermediate degree of penetration between surface blowing and deep blowing.

A significant difference between the teachings of the specification of the patent in suit and the Schwarz and Miles patents is that the patent in suit places a maximum limit on penetration with reference to the formation of a fluid slag. The Schwarz and Miles patents contain no such teaching, and, therefore, a steelmaker following the teachings of Schwarz and Miles might well blow oxygen deeper into the bath than the maximum limit permitted by the teachings of the pat-

ent in suit and thereby fail to obtain the fluid slag necessary for adequate phosphorus and sulphur removal. Such maximum limit on penetration appears to this Court to be the real gist of the invention by the patentees (see testimony of Dr. Trenkler, R. 11,904-05), and seems to have been unobvious, in view of the apparent failure of steelmakers to observe such limit of penetration following the teachings of the Schwarz and Miles patents.

(4) NONOBVIOUSNESS OF THE CLAIMS

It is not clear that the actual invention of the Linz process is incorporated in the claims of the patent in suit. It is true that the Rinesch and Hauttmann affidavits in 1957 attributed a causal connection between the avoidance of deep penetration and the existence of the features of the patent claims, including a localized reaction zone, the avoidance of material agitation of the bath and a circulation caused by chemical reactions. For example, Dr. Rinesch stated (DX 116, p. 7):

> [58] "The important feature of the invention resides in controlling the force of the oxygen jet vertically impinging on the bath surface to cause a limited center of reaction to be created in the surface layer and to avoid deep penetration into the bath, whereby an automatic circulatory movement is obtained in the converter vessel, and the entire charge is refined by the oxygen molten metal reactions in the limited center and the slag-metal reactions in the bath surrounding the reaction center."

However, it is a serious question whether persons skilled in the art of steelmaking in 1950 would have un-

derstood the features of the claims of the patent in suit as depending upon the avoidance of deep penetration for their existence. In other words, it is questionable whether the claims of the patent in suit have any clear connection with what appears to this Court to be the actual invention by the patentees. Such issue, however, arises under Section 112 rather than Section 103 and will be discussed below. As already noted, the *Graham* case, *supra,* 383 U. S. 1, at p. 17, makes clear that the issue under Section 103 requires an analysis of the differences between the prior art and the *claims* at issue, since only the subject matter of the claims constitutes "subject matter sought to be patented" within the meaning of Section 103. The issue under Section 103 is the obviousness of the subject matter of the claims to persons skilled in the art and not the obviousness of unclaimed subject matter disclosed by the specification, which constitutes a dedication to the public. *Edward Miller & Co. v. Bridgeport Brass Co.,* 104 U. S. 350, 352 (1881).

First of all, it is doubtful whether the claim of vertical blowing would have been obvious to steelmakers in 1950 in view of the unspecific teaching of Schwarz on the point and the recommendation of Miles to blow at an angle of between 30 and 75 [59] degrees.

The claim of blowing "onto and below the surface of the bath at the central portion thereof, to an extent to avoid material agitation of the bath by the oxygen stream" is almost certainly nonobvious in view of Miles' teaching that when the oxygen jet was blown below the surface, the jet agitated the bath. Further, it is defendant's position that agitation of the bath in McLouth's

steelmaking operation is largely the result of the mechanical action of the oxygen jet. Plaintiffs contend that material agitation of the bath is agitation sufficient to overcome the alleged down in center circulation of the bath created by chemical reactions. (E.g., main brief, p. 191.) Such a concept would certainly not have been obvious to steelmakers in 1950, since at that time the very idea of a down in center circulation caused by chemical reactions was not generally known to persons skilled in the art. Indeed, the concept of a down in center circulation of the bath caused by chemical reactions is not a well recognized and accepted phenomenon, even today. There is disagreement in the expert testimony in this litigation as to its existence; it is not clearly taught by the specification of the patent in suit; and other patents, notably the Cuscoleca and Walker patents, advance alternative theories of circulation relating to chemical reactions. (DX 68.) But if a down in center circulation caused by chemical reaction is itself not necessarily obvious to steelmakers even today, it is difficult to understand how the idea of avoiding a material agitation of the bath by a jet which would overcome such a circulation would be obvious.

The language in the claims of the patent in suit concerning the avoidance of material agitation was an apparent [60] effort by the applicants to distinguish the prior art Miles patent, which taught that a jet agitates the bath. At the time this feature of the patent claims was first presented in June of 1957, previous claims had been rejected as unpatentable over Miles. There was, therefore, the necessity for presenting new claims which in some manner would distinguish the Miles patent in

order to obtain a patent grant. It is significant also to note that the patent itself issued less than two months after the final claims including language referring to the avoidance of material agitation were submitted to the Patent Office. Previous to June, 1957, no reference had been made to the concept of avoidance of material agitation by the oxygen stream anywhere in the file wrapper history of the patent insuit. Incidentally, the concept is not mentioned in any of the foreign patents on the Linz process granted to Dr. Suess. (DX 83.)

The "localized reaction zone spaced a substantial distance from the refractory lining" and the "high temperature" in such reaction zone are features of the claims which this Court considers anticipated by the Schwarz and Miles patents and therefore certainly obvious to persons skilled in the art. The Schwarz patent states:

> ". . . the reaction between oxygen and iron or iron-accompanying substances with the phenomena resulting therefrom, namely local overheating and the accumulation of ferrous oxide, takes place in the center of the steel bath and therefore the walls of the vessel are not substantially attacked." (DX 61, Schwarz, pp. 4-5.)

Miles' teaching that "the source of chemical oxidation reaction is located within the bath at a good distance from the refractory lining" implies a localized reaction zone, and, further, Miles' teaching of blowing oxidizable elements in with the jet to [61] "increase the temperature locally where the jet strikes the bath so as to bring about the oxidizing action more rapidly" suggests a localized reaction zone with higher temperatures than the rest of the bath. (DX 61, Miles, pp. 3 and 15.)

The nonobviousness of the claim of a circulatory movement in the molten metal produced by chemical reactions has already been discussed in connection with the claim of avoidance of material agitation. It seems clear to this Court that such a reaction-induced circulation would not have been obvious to steelmakers in 1950, especially in view of the teaching of the Miles patent that the action of the jet agitates and circulates the bath, and also in view of the disagreement among the expert witnesses at the trial, even in 1964, whether such a reaction-induced circulation in fact exists.

Defendant in effect concedes the nonobviousness of the subject matter of the claims of the patent in suit by repeatedly contending in its opening statement, its briefs after trial and its final arguments that the process of the claims does not exist, or, in other words, that there is no such thing in steelmaking as a reaction-induced circulation or the avoidance of material agitation of the bath by the oxygen stream.

On opening statement, counsel for defendant stated:

> "They [Schwarz and Miles] weren't compelled to resort to the subterfuges of the patent in suit. They didn't have any absurdities about the avoidance of material agitation. So there are differences between the patent in suit and Schwarz and Miles.
>
> "But to the extent that the patent in suit departs from Schwarz and Miles it is pure phoney, nonpracticed, non-known, in any commercial operation in the world." (R. 143-44.)

[62] Defendant's main brief after trial states:

"The patent, in teaching a down-in-the-center circulation, taught something which does not exist. And the claims of the patent, in calling for a reaction-induced circulation, call for something else which does not exist." (P. 189; see also 177, 210-11.)

Similarly, defendant's reply brief states:

"The reaction-induced circulation comes into this case only through the claims of the patent in suit, and, in fact, does *not* exist." (P. 40. Emphasis is in original.)

Further, defendant's proposed finding of fact No. 83 requests the Court to find that "the claims in requiring that circulation be produced by chemical reaction, call for something which does not exist."

On final argument, the following colloquy occurred:

"*The Court*: Of course, if the process is as the patent claims to be, then it would be a patentable invention; there wouldn't be any question about that, would there?

"[*Counsel for Defendant*]: Well, if they had a circulation which was induced by chemical reaction, and if they had a circulation down in the center, they would have something that no one has ever heard of before; and so conceivably that would be an invention. Its application to the making of steel is something else again. I don't know whether it would work or not. But it's something that no one has ever faced, because they can't do it.

"*The Court*: Well, I mean, if the claims were supported and taught by the specifications, it would be a patentable invention, would it not?

"[*Counsel for Defendant*]: If the claims were supported in the sense that there was such a circulation, it would certainly be entirely new. It is something of which the world has never heard, and something which, except for the testimony in this case, there is no support anywhere in any scientific annal of which anybody in this case has ever heard. Plaintiffs have been challenged to bring forward some substantiation, and they haven't come forward with an iota." (R. 13,511-12; see also R. 13,711.)

[63] Assuming defendant is correct in contending that the process as claimed in the patent in suit does not exist in actual steelmaking operations, it follows that the process as claimed could not have been obvious to persons skilled in the art.

(5) CONCLUSION

In short, this Court concludes that defendant has not sustained its burden of proving that the subject matter of the claims of the patent in suit would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. In reaching such conclusion, the Court draws a clear distinction between the subject matter of the claims and the subject matter of the specification, also found unobvious. The specification discloses the gist of the invention of the patentees, to avoid blowing deeply so as to assure the formation of an early fluid slag. The long-standing need for such an in-

vention; the many unsuccessful attempts to solve the problem in the years prior to 1949; the significant advantages of the invention; and the enthusiastic reaction of the industry to the invention after a period of initial skepticism, all clearly indicate that the invention by the patentees, the Linz process, was not obvious to persons skilled in the art.

It should be noted that the defendant's position on the issue of obviousness has been equivocal throughout this litigation. Although the pretrial order states an issue in the language of Section 103, the opening statements and briefs of defendant after trial never expressly referred to Section 103. Instead, defendant contended vaguely that the patent in suit was invalid for lack of invention over the Schwarz and Miles patents, a confusing contention which could invoke defenses under either Section [64] 102 or Section 103. On closing arguments, defendant did expressly rely on Section 103 (R. 13,410), but practically conceded nonobviousness of the subject matter of the claims of the patent in suit, as already noted. (R. 13,511-12.)

C. Inventorship

Defendant in this case has also raised an issue that the patentees of the patent in suit did not themselves invent the subject matter sought to be patented, but rather that the invention was entirely disclosed to the patentees by Dr. Durrer and Dr. Hellbruegge. Such a defense arises under 35 U.S.C. §102(f), which provides that a person shall not be entitled to a patent if "he did not himself invent the subject matter sought to be patented." As previously noted, Section 103 clarifies Sec-

tion 102 by adding a further requirement of nonobviousness for patentability, even if the invention is not "identically disclosed or described" to the patentee by someone else. Thus Section 103 makes clear that the test as to whether the patentees themselves invented the subject matter is whether it was "identically disclosed or described" to them by Dr. Durrer and Dr. Hellbruegge.

Section 282 of 35 U.S.C. places the burden of proof as to this issue on the defendant, as in all issues concerning the validity of the patent in suit. Defendant's burden of proving that the patentees were not the true inventors is heavy and requires evidence which is convincing perhaps even beyond a reasonable doubt. *Becton-Dickinson & Co. v. Robert P. Scherer Corp., et al.,* 106 F. Supp. 665 (E.D. Mich. 1952), affirmed 211 F. 2d 835; *Manton-Gaulin Mfg. Co. v. Dairy Machinery & Construction Co.,* [65] *Inc.,* 238 F. 210 (D. Conn. 1916), affirmed 247 F. 317; *Protector Last Reinforcing Co. v. John Pell & Son, Inc.,* 204 F. 453 (D. N.J. 1913). As Judge Tuttle of this District stated in *Fruehauf Trailer Co. v. Highway Trailer Co.,* 54 F. 2d 691, 702 (E.D. Mich. 1931), affirmed 67 F. 2d 558 (CCA 6, 1933):

> "To take up first the testimony of Learman relating to the first Borst patent coupling device particularly, tending to show that Borst stole his notions, I will say that we are now in a branch of the law, patent law, which is very clear and well settled. Any claim of that kind tending to destroy the originality of the patentee, before it can be entertained by the court, must be shown by very convincing and strong evidence. It is well recognized that the memory of man is not sufficient to meet

that test. There must be something more tangible. We look for records that fix dates, a very definite sort of thing to tie to . . ."

Incidentally, defendant does not appear to dispute the severity of its burden of proof on this issue. Thus, the issue with respect to inventorship is whether defendant has proved by evidence that is convincing beyond a reasonable doubt that the patentees did not themselves invent the subject matter of the patent in suit because the subject matter was identically disclosed to them by Dr. Durrer and Dr. Hellbruegge. To resolve this issue, the Court is obliged to consider evidence concerning the teachings and disclosures of Dr. Durrer and Dr. Hellbruegge to the patentees, the results achieved in steelmaking by Dr. Durrer, Dr. Hellbruegge and the patentees, and also relevant acts and statements by Dr. Durrer and Dr. Hellbruegge concerning oxygen steelmaking.

(1) THE TEACHINGS OF DR. DURRER AND DR. HELLBRUEGGE AND THE PATENTEES

Dr. Durrer and Dr. Hellbruegge were distinguished scientists and steelmakers particularly concerned with the use of [66] oxygen in steelmaking. Dr. Durrer had been an advocate of the use of pure oxygen in steelmaking as early as the 1930's, and both Dr. Durrer and Dr. Hellbruegge had had considerable independent experience in steelmaking by 1948. In the spring of that year, they commenced experiments at the Von Roll Steel Works in Gerlafingen, Switzerland, involving the use of oxygen blown from above into a molten pig iron bath. Such experiments continued at least intermittently

throughout 1948 and the spring of 1949. During that time, Dr. Durrer and Dr. Hellbruegge were in limited contact with Dr. Trenkler and Dr. Suess, two of the patentees, concerning the experiments at Gerlafingen. Dr. Hellbruegge in particular was enthusiastic about the results achieved, and notified Dr. Trenkler in April of 1949 that "We are now working for production." (DX 21 B, p. 1; see also pp. 11,817-18.) The process employed by Dr. Durrer and Dr. Hellbruegge at Gerlafingen was described in an article written by Dr. Hellbruegge appearing in 1950 in the magazine *Stahl und Eisen* (DX 61) and also by the testimony at trial of Dr. Durrer and Dr. Hellbruegge, as well as the patentees. It is admitted by defendant that the practice of Dr. Durrer and Dr. Hellbruegge at Gerlafingen was essentially indistinguishable from the teachings of the Schwarz patent. (E.g. R. 13,503.) In general, the practice at Gerlafingen consisted of blowing pure oxygen in a single jet initially at an angle, but in later tests, vertically down into the pig iron bath so as to achieve a deep penetration of the bath by the jet. Thus Dr. Hellbruegge states in his article (p. 5):

> "The blowing onto the bath must not be done with too little pressure, as otherwise there will be only a surface reaction. This means that too much oxygen is lost. The refining takes too long a time and the iron content of the slag will be too high."

[67] Dr. Hellbruegge further states (p. 7):

> "The pressure of the oxygen jet must be sufficiently strong to cause the jet to penetrate into the bath, especially at the beginning and toward the end of the melt."

Dr. Hellbruegge testified this was still his thinking at the time of trial (R. 4909-11; 4670). Further, in a letter written in 1952, he stated:

> "The oxygen process, as introduced at the time in Linz by Gerlafingen within the Study Group, does not in my opinion circumvent the Schwarz patent, since there is not simply top blowing, but the jet must penetrate deep, even though it need not be supersonic speed." (DX 89B (25), p. 4.)

At trial, Dr. Hellbruegge affirmed this statement as his thinking at the time. (R. 4667.)

Dr. Durrer testified at the trial that the Schwarz patent contained his ideas. (R. 5101.) Further, in the memorandum prepared by Dr. Hellbruegge of a meeting in Solothurn, Switzerland, held on June 9, 1949, it is stated:

> "In the case of Prof. Schwarz's patent applications there is in all probability concerned in accordance with Dr. Durrer's statement, the theft of intellectual property." (PX 301B, p. 4.)

This memorandum further indicates Dr. Durrer's opinion that the Schwarz patent resulted from discussions that Dr. Durrer himself had had with the Brassert Company in the 1930's. In any event, Dr. Durrer affirmed the similarity of his teachings to those of the Schwarz patent, regardless whether Dr. Durrer himself was the true inventor of the process claimed in the Schwarz patent. (R. 5100-01.)

Dr. Trenkler testified that Dr. Durrer and Dr. Hellbruegge taught deep penetration of the bath by the jet. (R. 11,950.) Dr. Hauttmann testified that the Durrer method corresponded [68] to that of Schwarz. (R. 2555-

56.) Defendant has admitted in its opening statement, final arguments and briefs after trial that Dr. Durrer and Dr. Hellbruegge taught deep blowing.[5]

Also, with regard to penetration, Dr. Trenkler testified that Dr. Durrer and Dr. Hellbruegge taught going as close to the bath as possible with the nozzle. (R. 11,-805, 11,870, 11,873, 11,894 11,931, 11,941.) The effect of such teaching would be, of course, to increase the depth of penetration of the bath by the oxygen jet.

In contrast to the teachings of Dr. Durrer and Dr. Hellbruegge as to the necessity of a deep penetration of the bath by the oxygen jet, the patentees taught the avoidance of deep penetration as the gist of their invention. The patent itself expressly teaches the avoidance of deep penetration at column 3, lines 46 and 74; col. 4, line 70; and col. 9, line 18. Also, the Rinesch affidavit (DX 116) states that "A satisfactory refining operation could be obtained as long as the oxygen jet does not penetrate deeply into the bath." The Hauttmann affidavit (DX 117) makes essentially the same statement. And Dr. Trenkler testified as to the importance of the avoidance of deep penetration in the process of the patent in suit. (R. 11,942 and 11,904.) Further, Dr. Suess was also apparently aware of the importance of avoiding deep penetration, as indicated by the claims of his original Austrian application (PX 2C) and the first four claims of the United States continuation-in-part

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5. See, for example, main brief p. 227 stating that the process of the patent is the process taught by Dr. Durrer, and also p. 152 ff. stating that the avoidance of deep penetration is a fiction in the patent suit. See also reply brief p. 42 stating that the teachings of Schwarz and Durrer are the same and both entailed deep blowing.

application. (PX 2A.) Thus [69] the teachings of Dr. Durrer and Dr. Hellbruegge that a deep penetration of the bath by the jet is essential are in contrast to the teachings of all four of the patentees that deep penetration must be avoided.

A further significant teaching of Dr. Durrer and Dr. Hellbruegge concerns the iron content of the slag. Apparently Dr. Durrer and Dr. Hellbruegge were concerned in their steelmaking experiments in keeping the iron content of the slag as low as possible. In the *Stahl und Eisen* article (DX 61, p. 13), Dr. Hellbruegge stated that when oxygen was blown with too small a pressure, the iron loss to the slag was too high. He also stated at p. 9 that in the satisfactory heats at Gerlafingen, the iron content of the slag varied between 9% and 11%. At trial, Dr. Hellbruegge testified that he wanted to keep the iron content of the slag as low as possible, but "unfortunately" he could not get it any lower than 9% in the Gerlafingen tests. (R. 4926.)

Dr. Trenkler testified that according to the teachings of Dr. Durrer and Dr. Hellbruegge, "the oxygen jet has to penetrate into the lower regions of the bath so that a corresponding bath movement by the oxygen stream will be insured and a low iron content of the slag can be obtained." (R. 11,894.)

In contrast, the patentees were not primarily concerned with keeping a low iron content in the slag during their steelmaking experiments. The Rinesch affidavit (DX 116, p. 4) notes that in the satisfactory June 25 series of tests at Linz "the iron content of the slag increased to an average of 14 to 20%." The patent itself teaches at col. 5, line 60, to col. 6, line 51, that a

certain amount of oxidized iron in the slag is essential for the formation of the early fluid slag which results in an [70] accelerated rate of phosphorous removal from the bath. At col. 6, line 44, the patent approves an iron content of from 9% to 18% in the slag "with generally higher FeO content in the slag at higher phosphorus contents in the pig iron." In other words, according to the teachings of the patent in suit, a higher iron content in the slag than that approved by Dr. Hellbruegge is deemed essential for adequate phosphorus removal from the bath. Apparently Dr. Durrer and Dr. Hellbruegge, unlike the patentees, were more concerned with keeping down the iron content of the slag than with lowering the phosphorus content of the bath to desirable levels for high quality steel.

(2) THE DISCLOSURES OF DR. DURRER AND DR. HELLBRUEGGE TO THE PATENTEES

On May 12, 1949, Dr. Trenkler, one of the patentees, made a visit to Gerlafingen, Switzerland, to acquaint himself with the work which Dr. Durrer and Dr. Hellbruegge had been carrying on. While at Gerlafingen, Dr. Trenkler had "thorough discussions" (R. 11,805) with Dr. Durrer and Dr. Hellbruegge concerning their work and received detailed information about the Gerlafingen operation which he later incorporated into a memo (DX 11B) dated May 15, 1949. This memo establishes the disclosure to Dr. Trenkler of:

1. The use of pure oxygen.
2. The use of a blowing method of steelmaking without additional heating of the bath.
3. Use of a 2-ton Bessemer converter.

4. Vertical blowing.

5. The use of an 8 mm. nozzle.

6. Seven atmospheres of blowing pressure.

[71]7. A scrap accumulation of 50% when Thomas pig iron is used and a 30% scrap accumulation with steel-pig.

8. The cost of oxygen as corresponding with air costs of a standard operation.

9. The quality of the steel produced as being "substantially more favorable in regard to impact tenacity and aging-impact tenacity than the Belgian Thomas iron with which it was compared."

With regard to nozzle bath distance, Dr. Trenkler testified at the trial that he was not given any numerical distance (R. 11,806-08, 11,931) despite his "thorough" discussions with Dr. Durrer and Dr. Hellbruegge. Dr. Trenkler testified that he was told only to go as close to the bath as possible with the nozzle (R. 11,805, 11,870, 11,873, 11,931, 11,941). On the other hand, Dr. Durrer and Dr. Hellbruegge testified at the trial that they mentioned to Dr. Trenkler a nozzle bath distance of 20 centimeters (roughly 8 inches). (R. 4593, 4621, 4652, 4928, 5022.) There appears from the record good reason to accept the testimony of Dr. Trenkler on this point over that of Dr. Durrer and Dr. Hellbruegge. In the only contemporary statement on the point, the Trenkler memo DX 11 B dated May 15, 1949, there was no mention of any nozzle bath distance disclosed by Dr. Durrer and Dr. Hellbruegge, even though there was no reason to omit such information from the memo at that

time if it had been given. Further, the evidence shows that the men at Linz wanted to follow the teachings of Dr. Durrer and Dr. Hellbruegge as well as Schwarz and Miles in the tests beginning June 17, 1949. (Dr. Hauttmann, R. 2659-60.) Dr. Trenkler noted in his memo DX 11B: "It is absolutely essential that we examine the relationships in blowing our steel-pig with oxygen by thorough testing." Yet Dr. Trenkler used a nozzle bath [72] distance of ten centimeters (roughly 4 inches) in the June 17th tests following the teachings of Dr. Durrer and Dr. Hellbruegge and thus went even closer to the bath with the nozzle than Dr. Durrer had done at Gerlafingen. It seems unlikely that Dr. Trenkler would have departed from the teachings of Dr. Durrer and Dr. Hellbruegge in this one particular in a series of tests which were intended to follow the teachings of Dr. Durrer and Dr. Hellbruegge. Significantly, in the June 17th series of tests, Dr. Trenkler got even poorer results with regard to phosphorus removal and refractory damage than Dr. Durrer and Dr. Hellbruegge had gotten at Gerlafingen, apparently because Dr. Trenkler placed the nozzle 10 centimeters closer to the bath. (See *infra* II C(3).) Thus, this Court finds as a fact that Dr. Trenkler was given no numerical nozzle bath distance by Dr. Durrer and Dr. Hellbruegge.

With respect to the type of nozzle to be used, Dr. Trenkler testified that he was told to use a water-cooled copper Laval nozzle. (R. 11,835.) There is no evidence in the record to the contrary.

It can, therefore, be seen that Dr. Durrer and Dr. Hellbruegge disclosed to the patentees details of a steel-making operation very similar to the operation in which

satisfactory low phosphorus steel was produced for the first time in the Linz tests on June 25, 1949. Indeed, Dr. Trenkler testified (R. 11,905) that the avoidance of deep blowing in the process at Linz was the only difference from the process of deep blowing at Gerlafingen. In like manner, Dr. Hauttmann testifed that the only changes in operating procedure made by the patentees from the June 17th tests following Dr. Durrer's teachings to the June 25th tests following the patentees' own ideas, were the change from a Laval [73] nozzle to a normal cylindrical nozzle and an increase in the nozzle bath distance from 10 centimeters to 15 centimeters. (R. 2665, 2246, 2256.) Plaintiffs also admitted on final arguments that the only mechanical changes in method from the teachings and disclosures of Dr. Durrer and Dr. Hellbruegge were the change from a Laval to a normal nozzle and an increase in the nozzle bath distance. (R. 13,184-87.)

Plaintiffs contend that Dr. Durrer and Dr. Hellbruegge did *not* disclose the concept of a reduced impact pressure of the jet on the bath so as to avoid deep penetration. Such avoidance of deep penetration, according to the plaintiffs, is "the new concept, the new mental approach" of the patentees. (R. 13,184-87.) It is not disputed that the change in nozzle type and nozzle bath distance by the patentees would have had the effect of reducing impact pressure and therefore reducing the depth of penetration. Whether such a reduction in penetration by the patentees should be considered significant for patent purposes could only be determined by a comparison of the actual results achieved by the tests at Gerlafingen and Linz. If there were no significant

differences in the quality of steel produced, the difference in the degree of penetration of the bath by the jet would have no significance, and this Court would be forced to conclude that the process at Linz was in fact disclosed in its entirety by Dr. Durrer and Dr. Hellbruegge so as to establish a defense of non-inventorship by the patentees in this case. However, analyses of the steel produced in a number of experiments at Gerlafingen and at Linz, as listed in the *Stahl und Eisen* article by Dr. Hellbruegge (DX 61, p. 11) and a work sheet (DX 116A) attached to the Rinesch affidavit (DX 116), indicate clearly that the results of the Linz tests [74] beginning June 25th were superior to those at Gerlafingen.

(3) COMPARISON OF THE TESTS AT GERLAFINGEN, SWITZERLAND, AND LINZ, AUSTRIA

In the Gerlafingen tests of record, the steel produced had a relatively high phosphorus content with only 2 of 20 heats having a phosphorus content of less than .03%. The Linz June 17th tests, following Dr. Durrer's teachings but blowing even closer to the bath than Dr. Durrer had done at Gerlafingen, had an even higher phosphorous content in the steel produced, with none of the 6 heats containing less than .07% phosphorus. On the other hand, the June 25th tests at Linz obtained satisfactory phosphorus removal, with 6 of 11 heats containing below .03% phosphorus.

The Court has prepared a series of charts based on information taken from DX 61 and DX 116A concerning phosphorus content in the steel produced in the experi-

ments at Gerlafingen and Linz.[6] [75] Specifically, Chart 4, prepared by the Court, is a comparison by percentages of the heats run at Gerlafingen and at Linz with regard to the phosphorus content of the steel produced. It is

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6. Chart 1 shows what percentage of the 20 heats at Gerlafingen reported in Dr. Hellbruegge's *Stahl und Eisen* article were below certain levels of phosphorus in the final steel produced:

CHART I	*Gerlafingen tests*
20 of 20 heats below	.1 % P— 100%
18 of 20 " "	.09 % P— 90%
17 of 20 " "	.08 % P— 85%
12 of 20 " "	.07 % P— 60%
10 of 20 " "	.06 % P— 50%
7 of 20 " "	.05 % P— 35%
3 of 20 " "	.04 % P— 15%
2 of 20 " "	.03 % P— 10%
None of 20 " "	.02 % P— 0%

Chart 2 gives the same information with respect to the 6 heats of the June 17th series of tests at Linz attempting to follow the teachings of Dr. Durrer. The chart is based on two different measurements of phosphorus content in the bath, the first being an analysis of the phosphorus content of the final steel in the converter, and the second being an analysis of the phosphorus content of the steel during the pouring from the ladle into the ingot:

CHART 2 — June 17th tests at Linz

In converter	*During pouring*
2 of 6 heats below .1 — 33%	3 below .1 — 50%
1 of 6 heats below .09 — 17%	2 below .09 — 33%
1 of 6 heats below .08 — 17%	1 below .08 — 17%
None of 6 heats " .07 — 0%	None below .07 — 0%

Chart 3 gives the same information with respect to the heats reported in DX 116A from the June 25th series of tests at Linz, departing from the teachings of Dr.

important to emphasize once again at this point the desirability of a low phorphorus content, i.e., no more than .03% for satisfactory high quality steel. Higher concentrations of phosphorus tend to harden and brittle the

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Durrer by reducing impact pressure and consequently reducing penetration. An analysis of the phosphorus content of the final steel in the converter was reported in 10 heats of the June 25th series of tests. However, the phosphorus content of the steel poured from the ladle into the ingot is reported in 11 heats of this June 25th series of tests at Linz:

CHART 3 — June 25th tests at Linz

In converter	*During pouring*
10 of 10 heats below .07 — 100%	10 of 11 heats below .07 — 91%
8 of 10 heats below .06 — 80%	10 of 11 heats below .06 — 91%
6 of 10 heats below .05 — 60%	10 of 11 heats below .05 — 91%
5 of 10 heats below .04 — 50%	8 of 11 heats below .04 — 73%
4 of 10 heats below .03 — 40%	6 of 11 heats below .03 — 55%
None of 10 heats " .02 — 0%	1 of 11 heats below .02 — 9%

Significantly, in the June 25th series of tests, heats having the greatest nozzle bath distance, and, therefore, the lowest impact pressure, generally had the lowest phosphorus content in the steel produced.

CHART 4

% of Heats Containing Below	*Gerlafingen*	*Durrer Method (Linz June 17th)*		*Patentees' Method (Linz June 25th)*	
		Converter	*Pouring*	*Converter*	*Pouring*
.1 P	100%	33%	50%	100%	100%
.09 P	90%	17%	33%	100%	100%
.08 P	85%	17%	17%	100%	100%
.07 P	60%	0%	0%	100%	91%
.06 P	50%	0%	0%	80%	91%
.05 P	35%	0%	0%	60%	91%
.04 P	15%	0%	0%	50%	73%
.03 P	10%	0%	0%	40%	55%
.02 P	0%	0%	0%	0%	9%

steel and therefore limit its usefulness for many purposes. (Dr. Chipman, R. 235.) Dr. Trenkler also testified that "high phosphorus content excludes the use of the steel for all, almost all, qualities of thin sheets and deep drawing quality sheets." (R. 11,929.) Chart 4 illustrates that [76] the June 25th series of tests at Linz had significantly lower phosphorus content in the steel produced than either the previous tests at Gerlafingen or the June 17th series of tests at Linz. The striking disparities in the results of these three series of tests appears to this Court to be attributable solely to differences of impact pressures caused by the variation in the type of nozzle used or nozzle bath distance, or both.

Further, the available information with respect to the iron content of the slag in the tests at Gerlafingen and at Linz indicates an inverse correlation between the iron content of the slag and the phosphorus content of the steel produced. In the Gerlafingen tests, according to Dr. Hellbruegge, the iron content of the slag varied between 9% and 11%. (DX 61, *Stahl und Eisen* article, p. 9; R. 4926.) In the Linz June 17th series of tests involving even deeper penetration than achieved at Gerlafingen, the iron content of the slag varied from 6.7% to 9.8% [77] (DX 116A.) On the other hand, in the June 25th tests, the iron content of the slag varied from 9.6% to 33.9% with 9 of 11 heats reported being roughly in the range of 11% to 20%. (DX 116A.)

Chart 5, also prepared by the Court, illustrates an inverse correlation between the iron content of the slag and the phosphorus content of the steel in the tests at Gerlafingen and at Linz, or, in other words, illustrating that the higher the iron content of the slag becomes, at

least within the limit of the tests reported, the lower the phosphorus content of the steel tends to be.[7]

The Rinesch affidavit explains this correlation by pointing out that a slag with high iron content "forms with limestone a very fluid, lime-ferrite slag which absorbs the phorphorous as shown by the fact that it contains an average of 1.2 to 1.8% P_2O_5, as compared with 0.18% to 0.3% P_2O_5 in the slag which was formed by the deeply penetrating oxygen stream." (DX 116, p. 4.) The Rinesch affidavit also states that with deep penetration "the slag was unable to absorb FeO which, in its turn, is needed for [78] good dephosphorization." (P. 3.) Dr. Trenkler testified that "when you blow deeply the formation of the basic slag that you need for the phosphorus removal occurs too late." (R. 11,942; see also Dr. Chipman, R. 442-44.) The patent itself also teaches the necessity of an early fluid slag rich in oxides such as FeO for adequate phosphorus removal. (Col. 5, line 60, to col. 6, line 51.) Additionally, Dr. Chipman testified in detail (R. 583-87 and 606) concerning the chemistry of phosphorus removal in the Linz process. Briefly, he testi-

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7. *CHART 5*

Tests	*Iron in Slag*	*Phosphorus in Steel*	
Gerlafingen	9 —11%	— 35% of heats below	.05% P
		— 10% of " "	.03% P
Linz, June 17	6.7— 9.8%	— 0% of heats below	.05% P
Linz, June 25	9.6—33.9%	— 60% of heats in converter below	.05% P
	(mainly 11 —20%)	40% of heats in converter below	.03% P
		91% of heats during pouring below	.05% P
		55% of heats during pouring below	.03% P

fied that phosphorus is removed from the bath into the slag by slag-metal reactions written as follows in PX 151:

$$2\,P\ (\text{in bath}) + 5\,FeO\ (\text{in slag}) + 3\,CaO\ (\text{in slag}) = 3\,CaO{\cdot}P_2O_5 + 5\,Fe$$

$$2\,P\ (\text{in bath}) + 5\,O\ (\text{in bath}) + 3\,CaO\ (\text{in slag}) = 3\,CaO{\cdot}P_2O_5$$

Dr. Chipman illustrated (PX 152 and 153) the effect of penetration on slag formation. The diagram in PX 152 indicated that the avoidance of deep penetration results in the formation of a slag with high FeO content. PX 153 illustrates, on the other hand, that deeper penetration puts oxygen into the metal rather than the slag, which, therefore, has a low FeO content.

Another significant difference in the tests at Gerlafingen and at Linz is the use of an afterblow in the Gerlafingen tests to remove phosphorus. Dr. Hellbruegge testified that in the Gerlafingen tests, he had to have an afterblow to get rid of phosphorus. (R. 4915; see also R. 4929-30; DX 61, *Stahl und Eisen* article, pages 9 and 13.)

The patentees, on the other hand, apparently did not use an afterblow in the Linz tests; at least there is no evidence in this record that an afterblow was ever used at Linz. [79] However, the patent in col. 6, lines 16 to 25, indicates that no afterblow is required to remove phosphorus to the desired level since, according to the process disclosed by the patent in suit, "final phosphorus contents not higher than about 0.025% and as low as 0.010% are obtained by the time the carbon end point is reached with only a single slagging operation." Fur-

ther, Dr. Trenkler testified that "you have an afterblowing time only if you blow deeply." (R. 11,948.)

The absence of an afterblow at Linz is quite significant since even without an afterblow to remove phosphorus as at Gerlafingen, the phosphorus content of the steel produced in the June 25th series of tests at Linz was still lower than in the steel produced at Gerlafingen. This difference in result is apparently explained by a different order of chemical reaction when deep penetration was avoided. Thus, in the Linz tests, phosphorus was apparently removed from the bath at the same time as carbon and not afterwards, as at Gerlafingen. As Dr. Trenkler testified: "Owing to this type of blowing to the upper regions of the bath, we have an essentially earlier dissolution of the lime, a higher Fe content in the slag, and thereby a faster and better dephosphorization." (R. 11,904.) As already noted, the patent in suit teaches this phenomenon at col. 6, lines 16 to 25. The earlier removal of phosphorus in the Linz June 25th series of tests to even lower levels than in the Gerlafingen tests, and without the need for an afterblow, indicates strongly an entirely different steelmaking process taking place in the Linz June 25th series of tests than at Gerlafingen, despite a seemingly minor change in the operating procedures.

[80] There is a further significant contrast between the tests at Gerlafingen and the June 25th series of tests at Linz concerning refractory damage. There is a dispute in the evidence as to whether at Gerlafingen problems of refractory damage had been solved. Dr. Hellbruegge in his *Stahl und Eisen* article (DX 61, p. 14) stated that in the Gerlafingen operations: "There are no difficulties

with respect to the durability of the nozzle nor to that of the converter." On the other hand, Dr. Trenkler testified that he was told at Gerlafingen that Dr. Durrer and Dr. Hellbruegge had initially encountered difficulties concerning an insufficient life of the nozzle and an extremely short life of the refractory lining lasting only one to two heats. According to Dr. Trenkler: "The transition to the bent lance blowing vertically from above remedied the difficulties consisting in the burning of the nozzle— . . . and the difficulties concerning the refractory lining became smaller without ceasing altogether." (R. 11,838-39.) Dr. Trenkler also testified that "The insufficient life of the refractory lining of the converter" (R. 11,929) was a defect in the Gerlafingen operation. The Rinesch affidavit states that in the June 17, 1949, series of tests at Linz attempting to follow the teachings of Dr. Durrer and Dr. Hellbruegge, "The lining of the converter was eroded quickly so that cansiderable quantities of MgO were released from the lining." (DX 116, p. 3.) Further, the work sheet for the Linz tests (DX 116A) notes that in the June 17th series of tests, the converter lining was strongly eroded. The Hauttmann affidavit (DX 117) and the testimony of Dr. Trenkler (R. 11,901-04) also confirmed the existence of refractory damage in the June 17th series of tests. The refractory damage experienced in the June 17th series of [81] tests at Linz following the teachings of Dr. Durrer and Dr. Hellbruegge gives some reason to accept the testimony of Dr. Trenkler that problems of refractory damage had not been completely solved at Gerlafingen. Dr. Trenkler testified that the damage to the converter in the June 17th series of tests influenced a

series of tests beginning June 22nd so unfavorably because of the presence of MgO from the converter lining in the bath that the decision was made to reline the converter and commence a new series of tests on June 25th. (R. 11,943.) In the June 25th series of tests, which involved a reduction in impact pressure of the jet on the bath by means of an increase of nozzle bath distance and the use of a normal nozzle rather than a Laval nozzle, no refractory damage was experienced. (DX 116, 116A.)

The contrast between the June 17th series and the June 25th series of tests at Linz with regard to refractory damage is illustrated by analyses of the magnesium oxide (MgO) content of the slag on the final steel in the converter in these tests. In the June 17th series of tests, the MgO content of the slag varied between 25.87% and 34.3%. In the June 25 tests, on the other hand, the MgO content of the slag varied between 2.08% and 11.16%. Incidentally, no such information is in evidence for the Gerlafingen tests. The significance of the MgO content of the slag lies in the fact that magnesium is not originally contained either in the pig iron or in slag additions to the heat, but comes entirely from the converter lining. The MgO content of the slag, therefore, is a significant measure of refractory wear. (Dr. Trenkler, R. 11,943, 11,943 A.) The substantially lower MgO content of the slag in the June 25th series of tests is objective [82] evidence of a considerable improvement in refractory life over the June 17th series of tests.

The marked improvement in the quality of the steel produced in regard to phosphorus removal in the June 25th series of tests without even the use of an

afterblow, and also the considerable improvement in refractory life indicate strongly to this Court that the June 25th tests at Linz represented a different and more successful process than had been practiced or disclosed by Dr. Durrer and Dr. Hellbruegge. These tests, involving a relatively low impact pressure of the jet on the bath as opposed to the recommendation of Dr. Durrer and Dr. Hellbruegge, remedied what Dr. Trenkler had stated to be the two major defects of the Gerlafingen process, namely, excessive phosphorus content in the steel produced and insufficient refractory life. (R. 11,929.)

(4) STATEMENTS BY DR. DURRER AND DR. HELLBRUEGGE INCONSISTENT WITH INVENTORSHIP

Contemporary statements by Dr. Durrer establish clearly his own opinion that he had nothing patentable to disclose to the men at Linz with regard to an oxygen steelmaking process. In a speech given by Dr. Durrer on May 20, 1949, at Leoben, Austria (PX 307B), Dr. Durrer discussed in general terms the state of the art with regard to oxygen steelmaking. This speech was given roughly a week after Dr. Trenkler's visit to Gerlafingen, at which time defendant contends the invention of the patentees was entirely disclosed to Dr. Trenkler by Dr. Durrer and Dr. Hellbruegge. In this speech, Dr. Durrer stated:

> "What conclusions may now be drawn for the recovery of iron in Austria? In my opinion your native raw materials are suitable for smelting both in the electric low shaft furnace and in the oxygen low shaft furnace; as for the economic [83] feasibil-

ity of the problem, I, as a Swiss, cannot make any judgment, but rather only the suggestion that you investigate both procedures very thoroughly. *The question of converting pig iron into steel by means of high purity oxygen ought also to be studied;* it does not seem to be at all out of the question that this method could be of great interest for your country.

"All these ideas are still in the developmental stage, but already they indicate the direction which should be taken. In evaluating and pursuing these ideas—if we wish to do a good deed for the more distant future—we must not let ourselves be guided by monetary considerations." (Emphasis supplied.)

Dr. Durrer affirmed this statement as representing his views at that time. (R. 5098-5098A.) In the speech at Leoben, Dr. Durrer did not announce the discovery of a satisfactory steelmaking process which defendant now attributes to him, although the occasion of the speech gave him an excellent opportunity to do so had he, in fact, made such a discovery.

Dr. Durrer's speech at Leoben was delivered at a conference between representatives of four steel companies including Dr. Durrer's company, von Roll, and VOEST. According to DX 24B, a memorandum prepared by Dr. Suess setting forth conclusions of this conference it was stated:

"In conferences in Leoben from May 19 to 21, 1949, it was decided to undertake a mutual study of the question of Oxygen Blowing in iron works by the Von Roll'sche Iron Works Gerlafingen, Huetten-

werk Huckingen Ag., Alpine Montangesellschaft Donawitz and VOEST Linz. In a discussion between Prof. Durrer, Dir. Springorum, Dr. Leitner, General-direktor Oberegger, Dr. Matuschka and Suess on May 21, 1949, the following procedure was outlined as follows:

"1) All experience and know-how in this field that is or will be at the disposal of the plants, will be reciprocally put at the disposal of all.

"2) The tests that are to be carried out will be financed by the individual plants that conduct them. If the tests should be on a larger scale or if tests for other plants should be conducted, [84] then a distribution of the costs can be discussed.

"3) There will be another conference for the final setting up of this cooperation, to take place in about 4 to 5 weeks in Linz.

"4) In the near future tests will be begun in Huckingen and in Linz with the blowing of pure oxygen in converters or vessels suitable for this process.

"5) Dr. Durrer will act as secretary for this mutual undertaking."

It is difficult to understand why such an arrangement as that disclosed in the memorandum of the Leoben conference (DX 24B) would have been entered into by Dr. Durrer's company if Dr. Durrer and Dr. Hellbruegge had themselves already achieved satisfactory results with oxygen steelmaking experiments at Gerlafingen. If the Gerlafingen results had actually been satisfactory, it is more likely that Dr. Durrer's company

would have attempted to exploit commercially the new steelmaking process for its own sole benefit rather than enter into a joint experimental program with other steel companies and make available all know-how previously arrived at.

In a letter dated May 28, 1949 (DX 89B (6)), acknowledging receipt of the memorandum (DX 24B) of the Leoben conference, Dr. Durrer replied to Dr. Suess:

> "I was overjoyed by the unanimous agreement to carry out the planned joint work and I hope and trust that it will bring us the desired results. The conditions for our work are very favorable, both with regard to subject matter and with respect to the human factor and we will jointly attack the great problem in a spirit of mutual trust."

Dr. Durrer testified that the "great problem" referred to in his letter was the refining of pig iron by blowing it with oxygen. (R. 5099-5100.) However, if the Gerlafingen tests had [85] been as successful as defendant now contends, oxygen steelmaking would no longer have been such a "great problem" as Dr. Durrer apparently believed on May 28, 1949.

On June 9, 1949, a conference between representatives of the four steel companies was held at Solothurn, Switzerland, to discuss the joint work in oxygen steelmaking earlier agreed upon at the Leoben conference. Dr. Hellbruegge prepared a file memorandum (PX 301B) of the Solothurn conference two days later. In this memorandum, it is stated at p. 4:

> "With respect to possible patent applications, Dr. Durrer is of the opinion that this should be decided

only after something on which patent application can be filed is actually on hand. Furthermore, in the course of the discussion, one arrives at the opinion that it would be better to leave the individual parties free to apply for patents or not."

At trial (R. 5107), when asked the question:

"Q. So that your position as of June 9, 1949, was that nothing on which patent application could be filed was actually at hand; is that correct?"

Dr. Durrer replied:

"A. This is correct. And even today I am still of the conviction that the only basic patent for oxygen top blowing is that of Henry Bessemer.

"Q. Dated as of what date, Doctor?

"A. 1856 or 1855."

This answer indicates clearly that Dr. Durrer did not believe in June of 1949 that he had anything patentable over Schwarz or even Bessemer. (See also R. 5215.)

As previously noted, this memorandum (PX 301B) and Dr. Durrer's testimony at trial also indicate Dr. Durrer's opinion at the time of the Solothurn conference that the Schwarz patent [86] contained Dr. Durrer's ideas and that "a patent which contains my ideas does not impede me from using it." (R. 5101.)

Dr. Durrer also testified at trial that Schwarz' work gave no practical results so far as the refining of pig iron into steel by oxygen is concerned. (R. 5084-85.) It would seem to follow that if Schwarz' work led to no practical results, Dr. Durrer's ideas, allegedly contained

in the Schwarz patent, would also have led to no practical results.

It is important to note that neither Dr. Durrer nor Dr. Hellbruegge apparently sought a patent themselves on the basis of the Gerlafingen tests in the spring of 1949. Dr. Hellbruegge admitted at trial that he never filed a patent application on the work done by him concerning the top blowing of oxygen on pig iron in a converter. (R. 4970.) Records of the United States Patent Office show that Dr. Durrer executed assignments of 29 separate patent applications between May 28, 1947, and April 28, 1948 (PX 317), which indicates that he had an active interest in seeking patents. Yet Dr. Durrer admitted at trial that no patent was granted to him covering the steelmaking process experiments at Gerlafingen (R. 5215), and he also admitted that he did not himself file any patent applications (R. 5202). He further testified that he did not know whether his company had filed any such application (R. 5202-03; 5215.) However, there is no evidence in the record of any such application, either by Dr. Durrer himself or his company.

According to PX 302B, a memorandum by Dr. Suess, one of the patentees, covering a conference with Dr. Durrer and Dr. Hellbruegge on September 9 and 10, 1949, the latter two men were [87] of the opinion at that time that new patents should be applied for by the individual companies, but with benefits and participation to all the partners. The same memorandum shows that Dr. Durrer and Dr. Hellbruegge were familiar with the success of the Linz tests in June, 1949, since they thought that a large steel plant could be built at once at Linz using the same process. Apparently, therefore,

Dr. Durrer and Dr. Hellbruegge were content to allow the patentees to apply for a patent on the process at Linz rather than seek a patent themselves. Dr. Durrer was aware of the Suess patent applications in Austria and Switzerland (PX 316B, PX 312B; R. 5199-5200; and R. 5187); and yet he admitted that he never filed an opposition to Suess' applications anywhere in the world and did not remember any such opposition by his company. (R. 5218.)

In a memorandum (DX 89B (20)) dated December 14, 1949, relating to a discussion between Dr. Durrer and Dr. Suess, Dr. Durrer noted that on the basis of the excellent results of the Linz experiments, Linz had decided to construct an oxygen steel plant. Dr. Durrer further stated:

> "The good results consist in particular in the very low contents of carbon, phorphorous and sulfur, *which contradicts all metallurgical expectations. This work shows a new metallurgy with which we must first of all become acquainted.* Presumably, the extensive removal of these substances is due to the higher temperature, the higher degree of liquidity connected therewith and the higher reaction velocity resulting therefrom." (Emphasis supplied.)

This statement appears to contrast the successful work at Linz with the previous experiments at Gerlafingen. Dr. Durrer in his statement registered surprise at the good results of the Linz work, which clearly suggests that comparable results had [88] not been achieved at Gerlafingen by Dr. Durrer himself.

Also, in a letter (DX 89B (22)) by Dr. Durrer to Dr. Suess dated May 5 1950, Dr. Durrer states:

> ". . . the very successful tests conducted by you have shown that the process based on your steel pig-iron is ready for production. I had not expected you to be able to solve this problem so quickly, and am therefore all the more delighted, now that I have been able to see the beautiful results with my own eyes. Now that the problem has been solved in principle, it is only a question in the further tests of details, of polishing up the process, so to speak . . .
>
> "To you and your co-workers my most sincere congratulations on this important metallurgical progress."

This letter must be read in light of DX 89B (21), a letter from Dr. Suess to Dr. Durrer requesting some such congratulations in order to assist Dr. Suess in his negotiations with his employer VOEST concerning the oxygen steelmaking process at Linz. Such a solicited response is not as convincing evidence of non-inventorship by Dr. Durrer himself as his memorandum (DX 89B (20)) of December 14, 1949. However, the fact that Dr. Durrer was willing to write such a letter extending his congratulations to Dr. Suess is some additional evidence of an advance in the art made by the patentees at Linz.

(5) CONCLUSION

Defendant has admitted repeatedly that the teachings of Schwarz and Dr. Durrer are essentially the same. (See, for example, p. 43 Reply Brief, R. 11,896.) On final argument, in response to the Court's statement:

> "Well, then, you admit that Schwarz and Miles and Durrer and Hellbruegge all teach the same method."

Counsel for defendant stated:

> [89] "There are minor detail differences, but so far as the basic method is concerned, they are alike as peas in a pod. There is no essential difference between them; and if we were able to urge one as doing something, we would have to admit that the other two did the same thing in broad concept." R. 13,503.)

However, defendant also admitted that Schwarz' teachings did not anticipate the patent in suit. (See, for example, R. 143-44, 13,410.) It follows that Dr. Durrer's teachings, admittedly the same as Schwarz', would also fail to anticipate the patent in suit and that Dr. Durrer could not have identically disclosed the subject matter of the patent in suit to the patentees.

It should be noted that at p. 42 of its Reply Brief, defendant attempted to confuse the issue concerning the Durrer and Hellbruegge disclosures, stating:

> ". . . the process of the patent in suit, when compared with the sum of what was learned from Dr. Durrer and Dr. Hellbruegge, must represent an advance amounting to invention."

In effect, this is a statement that the issue is one of obviousness over the Durrer and Hellbruegge disclosures and, therefore, arises under Section 103 rather than Section 102(f), upon which defendant had earlier relied. (See Main Brief, p. 223.) As already discussed, obviousness over the teachings of Dr. Durrer and Dr. Hellbruegge is not an issue in this case, since the teachings of Dr. Durrer and Dr. Hellbruegge do not constitute prior art within the meaning of the patent statute.

In conclusion, this Court finds that the defendant has failed to carry its heavy burden of proving that the patentees did not themselves invent the subject matter of the patent in suit, but rather learned it from Dr. Durrer and Dr. Hellbruegge. [90] Indeed, the evidence indicates that defendant could not have sustained even a lesser burden of proof. In the opinion of this Court, a preponderance of the evidence establishes that the patentees rather than Dr. Durrer and Dr. Hellbruegge were, in fact, the true inventors of the subject matter of the patent in suit. Such conclusion is not intended in any way to minimize the enormous contributions that Dr. Durrer and Dr. Hellbruegge made to the art of steelmaking with oxygen. The ideas and experiments of Dr. Durrer and Dr. Hellbruegge certainly paved the way for the successful experiments at Linz in June of 1949. Indeed, in any objective sense, it would have to be said that Dr. Durrer and Dr. Hellbruegge contributed as much, if not more, to the discovery of the successful oxygen steelmaking process than the patentees. However, the patentees must be credited with the invention under applicable patent law, because they took the final step of reducing impact pressue so as to avoid refractory damage and to create the early fluid slag neces-

sary for satisfactory phosphorus removal. In all other respects, the Linz process is anticipated by the work at Gerlafingen. Yet this final step of reducing impact pressure was the difference between success and failure. In this Court's opinion, Dr. Durrer and Dr. Hellbruegge themselves might well have taken the final step if they had continued their own experiments. Certainly a great deal of credit is owing to Dr. Durrer and Dr. Hellbruegge as well as to the patentees by the steelmaking industry throughout the world for their great contributions to the art of steelmaking. Nevertheless, as the Supreme Court noted in *Cimiotti Unhairing Co. v. American Fur Refining Co.*, 198 U. S. 399, 409 (1905), the patentee had "taken the step which marks the difference between a successfully [91] operating machine and one which stops short of that point, and that advance entitles him to the protection of a patent."

D. Compliance of the Specification With § 112

Defendant has attacked both the specification and the claims of the patent in suit as being too indefinite to comply with the requirements of 35 U.S.C. §112, which provides in pertinent part:

> "The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention."

Section 112 requires simply a disclosure of the invention which would enable persons skilled in the per-

tinent art to practice the invention. As the Supreme Court stated in *Mowry v. Whitney,* 14 Wall. 620, 644 (1872):

> "The specification, then, is to be addressed to those skilled in the art, and is to be comprehensible by them. It may be sufficient, though the unskilled may not be able to gather from it how to use the invention. And it is evident that the definiteness of a specification must vary with the nature of its subject. Addressed as it is to those skilled in the art, it may leave something to their skill in applying the invention, but it should not mislead them."

Thus the issue under Section 112 with respect to the specification is whether the specification describes the invention sufficiently to enable steelmakers to make and use the invention. The burden of proof on this issue, as with all issues concerning validity, is upon defendant. 35 U.S.C. § 282.

[92] Defendant has made a number of objections to language as well as particular teachings or the lack of such teachings in the specification. Such objections are of no consequence if, despite their accuracy, persons skilled in the art of steelmaking reading the patent could, nevertheless, make and use the invention disclosed by the specification "without the necessity of further experiment itself of an inventive nature." *National Battery Co. v. Richardson Co.,* 63 F. 2d 289, 293 (CCA 6, 1933); *Sun Ray Gas Corporation v. Bellows-Claude Neon Co.,* 49 F. 2d 886, 887 (CCA 6, 1931.)

As the Sixth Circuit Court of Appeals stated in *Paul E. Hawkinson Co. v. Wilcoxen,* 149 F. 2d 471, 475 CA 6, 1945), cited by both parties:

"In determining the sufficiency of these patents the real test is, whether the disclosures in the specifications and claims make the inventions clear to a mechanic skilled in the art of tire retreading so that he could construct the apparatus and practice the method."

In this connection, Dr. Flinn, Professor of Metallurgical Engineering at the University of Michigan, who testified for defendant, admitted that a person skilled in the art could follow the teachings of the examples set forth in the specification and manufacture satisfactory steel. (R. 7885 and 7924.) The examples of the specification were limited to heats of 35 to 36 tons. Dr. Flinn was questioned as follows:

"Q. And the specific conditions there are given for 36-ton heats; right?

"A. Yes.

"Q. And if you follow those specific teachings, you get good steel; right?

"A. Yes." (R. 7924.)

[93] Dr. Flinn also testified that a steelmaker would have difficulty in making good steel following the teachings of the patent with respect to heats of sizes larger or smaller than the 36-ton example. Specifically, he testified:

"A. I think I would have to do a fair amount of experimenting, . . ." (R. 7938.)

The specification teaches a broad range of operating conditions which would cover larger or smaller heats. However, the patent does not give precise numerical teachings such as oxygen blowing pressure or nozzle bath distance to be used for heats of particular sizes

other than 36 tons. The patent states at col. 9, lines 13-17:

> "In general, it may be stated that as the oxygen pressure and nozzle diameter are increased, the nozzle spacing is also increased, for example, as the capacity of the refining vessel and total charge is increased."

According to Dr. Flinn, such teaching would not provide sufficient guidelines to persons skilled in the art desiring to manufacture steel in heat sizes of other than 36 tons. In any event, there seems to be no question that the 36-ton heat example of the specification has "set forth the best mode contemplated by the inventor of carrying out his invention," as required by Section 112.

Section 112 does not expressly require a disclosure of the invention so full and comprehensive that a person skilled in the art would not have to engage in any experimentation whatever to make and use the invention for his own particular purposes. Further experimentation of the sort in which Dr. Flinn felt the need to engage in order to make more than 36 tons of steel at a time is not condemned by Section 112, provided that such experimentation is not itself of an inventive nature. *National Battery* [94] *Co. v. Richardson Co., supra,* 63 F. 2d 289, 293 (CCA 6, 1933.)

As the Sixth Circuit Court of Appeals recently stated in *Tilotson Manufacturing Co. v. Textron, Inc., Homelite,* 336 F. 2d 833, 841 (CA 6, 1964):

> "A specific example of the carburetor was given in the specification. The fact that some testing may be required in calibrating carburetors for different

engines does not render the claims indefinite where adequate guideposts were furnished as here."

The real question, therefore, is whether the experimentation required to make satisfactory steel in heat sizes larger or smaller than the 36-ton example of the specification would be experimentation "of an inventive nature." In view of the teaching in the specification of a broad range of operating conditions for heats of various sizes and the instruction of col. 9, lines 13-17, that oxygen pressure and nozzle diameter are to be increased along with nozzle bath distance as the size of the heat is increased, and also in light of the general teaching at col. 3, lines 70-75, to avoid deep penetration so as to obtain a fluid slag and to avoid slopping, this Court concludes that the experimentation required to go to a different heat size would not be of an inventive nature. The specification teaches "necessary and required process conditions, such as fluid slag . . . and avoidance of slopping" (col. 3, lines 70-73), indicating the avoidance of a deep penetration. The specification also gives a broad range of operating conditions and an instruction as to their interrelation which would inform the steelmaker in general of the method of obtaining good steel in various heat sizes.

Significantly, McLouth's OP-2 shop, constructed in [95] 1958 and 1960, contains vessels with a capacity of 110 tons (R. 10,957), a considerably larger capacity than that of the OP-1 shop. Mr. Johnson, McLouth's Vice President in charge of engineering, and responsible for the design and construction of McLouth's OP-1 and OP-2 shops (R. 10,950-51), was not examined at trial by defendant concerning the alleged indefiniteness of the

specification, although he would have been the most qualified of defendant's witnesses to testify on this issue. However, plaintiffs put in evidence certain pertinent testimony from Mr. Johnson's deposition taken prior to trial. He apparently encountered no difficulty in going from the heat used in the OP-1 shop to the larger heat used in the OP-2 operation. Specifically, he testified at R. 3494-3497:

"Q. Now, just how did you determine the oxygen flow rates to be used on the 80 and 100 ton vessels in the No. 2 Shop?

"A. We believed from our experience on our No. 1 vessel that we had established certain maximum conditions. If you will remember from the interrogatories, it is necessary in the first few heats of the lining, for example, in Vessel No. 1 to charge for a 52-ton tap instead of a 60-ton. So that we believe that these vessels at our OP-1 Shop are operating at a limiting condition and that this was, I believed, good information, because many of us discussed this problem of limiting size, and to me, of course, the designer, the limit size is a very important number. I thought that we had established these conditions there so it was a simple extrapolation from these maximum conditions that we had determined from our operations.

"Q. What were these maximum conditions that you speak of? What did they relate to?

"A. Principally to depth of bath.

"Q. Flow rates also?

[96] "A. On flow rates also, in the respect that if depth of bath is established, then we would have an extrapolation of oxygen volume also.

"Q. Just how did you make that extrapolation in regard to the oxygen flow?

"A. In comparing tons of metal blown in the two vessels. The actual history is straight extrapolation gas from medium range 3400 to 5700, and considering an 80-ton heat size; and sometime after the units were built, because our operation was in the high part of the range, it was necessary for us to rebuild the oxygen controlling devices, so that the instruments would be more comfortably in the center of the range.

* * *

"Q. And what was the actual designed flow rate that you got by this extrapolation for the 100-ton vessel?

"A. On the 100 ton?

"Q. Yes.

"*Mr. Groner*: You mean by that the A. vessel?

"*Mr. Webb*: Yes.

"A. We in effect did not actually design that, Mr. Webb. The equipment, except for the vessel height, and the fact that we knew the flow meter range was not high enough, the equipment was purchased as being identical equipment, and the instruments for that vessel were bought to handle a higher-range, but we actually did not establish any number. We did not perform tests of lances or establish numbers for A Vessel. It was a simple addition of similar equipment with some improvement."

Mr. Johnson's testimony quoted above concerned primarily the specific features of oxygen flow rate and bath depth. However, there is no reason to assume that he would have given a different answer with respect to other operating factors, keeping in mind defendant's burden of proof on this issue and its failure to call Mr. Johnson as its own witness on this issue. In short, [97] according to defendant's own testimony, persons skilled in the art can make satisfactory steel following the teachings of the 36-ton heat example given in the specification, and a person skilled in the art can apparently extrapolate from such conditions to determine the operating conditions for larger heat sizes.

Additionally, Dr. Elliott demonstrated the manner in which a person skilled in the art of steelmaking in 1950, reading the patent, would be able to design operating conditions for a 100-ton heat. (PX 347; R. 6174-6245.) Such evidence was not refuted by defendant.

The above testimony is sufficient to resolve the issue of indefiniteness of the specification under Section 112. Therefore, this Court need not discuss in great detail defendant's various objections to the specification.

Defendant objects to the language referring to avoidance of deep penetration as a fiction and also a meaningless term. However, it has already been observed that the specification gives the phrase "avoidance of deep penetration" a special meaning by association with "necessary and required process conditions, such as fluid slag, avoidance of over-oxidation (undue loss of iron to the slag), and avoidance of slopping." (Col. 3, lines 70 to 73.) The patent further states: "The process conducted under these conditions

avoids a deep penetration of the oxygen gas into the molten bath which seriously impairs refractory life at the bottom of the refining vessel." (Col. 3, line 73, to col. 4, line 1.) Thus, according to the teaching of the specification, a steelmaker knows he is avoiding deep penetration within the meaning of the patent if he does not blow deeply enough to [98] cause refractory damage or to prevent the formation of a fluid slag, as Dr. Elliott and Dr. Hauttmann testified. (R. 6168-70; R. 2764.) Given this special meaning by the specification, the phrase "avoidance of deep penetration" is certainly not a fiction, since such process conditions as a fluid slag, the avoidance of slopping and the avoidance of refractory damage are admittedly part of the practice of steelmaking at McLouth. (R. 3483-85; 6692-93; 10,-986-92; 11,190-91.)

Defendant also complains that the expressions in the patent relating to "surface blowing" are fatally indefinite. Defendant contends that surface blowing means absence of any penetration whatever by the jet. Such a construction of the term "surface blowing" is inconsistent with the teachings of the patent to avoid deep penetration, which admittedly implies some penetration by the jet (R. 854), at least sufficient penetration to avoid slopping as specifically taught at col. 3, lines 70 to 75. Moreover, as Dr. Hauttmann testified:

> "The words 'surface blowing' only says [sic] that the jet is directed toward the surface, in contrast to what happens if a nozzle or an oxygen jet is blown from below directly into a melt." (R. 2494; see also Dr. Chipman, R. 959-60.)

Defendant's witness Dr. Flinn also recognized this distinction. (R. 8043.)

Defendant objects to the language in the specification referring to the "confined" or "localized" reaction zone as fatally indefinite. It is true that the specification gives the term no precise meaning or definition, at least in terms of numerical percentage of bath area or depth. However, the specification does make clear that the reaction zone must not be [99] of sufficiently large size to cause excessive refractory damage either to the bottom or walls of the vessel. (See, e.g., col. 3, line 73, to col. 4, line 6.) Although the term lacks precision, its indefiniteness would not prevent a steelmaker from making and using the invention on the basis of the disclosures of the specification. As Dr. Chipman testified, a localized reaction zone is characteristic of the process, and cannot be avoided in any event. (R. 907.)

Defendant objects to the alleged inadequacy of the teaching of the specification concerning the interrelation of the broad range of operating conditions taught by the patent. As already noted, the patent teaches at col. 9, lines 14 to 17, that "as the oxygen pressure and nozzle diameter are increased, the nozzle spacing is also increased, for example, as the capacity of the refining vessel and total charge is increased." Defendant contends that such teaching is not helpful because it does not teach to what extent the various operating conditions should be increased. The short answer to this contention is that the specification is directed to persons skilled in the art of steelmaking who, according to plaintiffs' witnesses at least, would be able to make the necessary correlation. As already discussed, experi-

mentation itself of an inventive nature would not be required to arrive at the appropriate correlation of operating conditions for heats of various sizes.

With regard to circulation, defendant contends that the patent's teaching of a down in center circulation is a teaching of a circulation that does not exist in fact. However, such a contention raises no problem under Section 112 concerning definiteness of the specification. The specification as a whole [100] might well be sufficiently definite to enable a steelmaker to make and use the invention, although one portion of the specification suggested a nonexistent phenomenon. Thus, the Court need not decide with respect to this issue whether circulation down in the center exists in fact, as suggested by the specification.

Defendant also objects to an allegedly inadequate disclosure in the specification concerning an appropriate nozzle. However, it was apparently the intent of the patentees that either the Laval nozzle or a normal converging nozzle could be used. (R. 11,906.) Defendant's counsel (R. 124) and its witness, Dr. Flinn (R. 8015), admitted that either a Laval or cylindrical nozzle could be used in practicing the patent process. Therefore, the failure of the patent to specify one type or the other as appropriate raises no issue under Section 112.

Defendant contends that the patent teaching with respect to nozzle diameter is erroneous. At col. 3, lines 59-61, the patent teaches a diameter of about one millimeter per ton of charge, which teaching plaintiffs admit would not apply universally to all heat sizes. (E.g., R. 6423-24.) However, plaintiffs' witnesses testified

that persons skilled in the art would not be misled by the patent teaching regarding nozzle diameter and would be able to compute a proper diameter for the desired heat size. (R. 6664-65; 2472-73.) Defendant has not sustained its burden of proving the contrary. Errors in a patent specification do not render a patent fatally indefinite under Section 112 if such errors do not mislead persons skilled in the art. *International Nickel Company v. Ford Motor Company,* 166 F. Supp. 551, 557 (S.D. N.Y., 1958).

Further, defendant objects to the many references in [101] the specification concerning "high temperatures" in the localized reaction zone as being too indefinite for failure to specify such temperatures in degrees. Again, such objection raises no issue under Section 112, although the term "high temperature" is indefinite, since the indefiniteness of the term in no way would impair the ability of a person skilled in the art to make and use the invention on the basis of the disclosure in the specification.

As the Supreme Court stated in *Eibel Process Company v. Minnesota & Ontario Paper Company,* 261 U. S. 45, 66 (1923):

> "Expressions quite as indefinite as 'high' and 'substantial' in describing an invention or discovery in patent specifications and claims have been recognized by this Court as sufficient."

Dr. Chipman testified that blowing vertically into a bath, a steelmaker cannot avoid the high temperatures referred to in the specification. (R. 1017.)

Finally, defendant refers to several admitted errors in the teachings of the specification. However, defendant has not sustained its burden of proving that such minor errors would mislead persons skilled in the art to such an extent that they would not be able to make and use the invention disclosed by the specification.

In sum, this Court finds that the specification of the patent in suit, despite certain indefiniteness and inaccuracies, nevertheless complies with Section 112 by disclosing the invention in sufficiently clear terms to enable steelmakers "to make and use the same." At least defendant has not sustained its burden of proving otherwise, especially in light of defendant's own testimony that persons skilled in the art could make satisfactory steel following the teachings of the example and that [102] extrapolation to other heat sizes was a simple matter. Defendant's failure to call its own steelmakers as witnesses on this issue weakens its attack on the specification under Section 112.

E. Compliance of the Claims With § 112

35 U.S.C., Section 112, provides in pertinent part:

> "The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention."

Defendant in this case has attacked the claims of the patent in suit as being too indefinite to determine the scope and content of the invention claimed and also as not supported by the specification. There is another objection, not separately argued by the defendant, that the claims do not cover the actual invention by the patentees, as required by Section 112.

(1) THE CLAIMS DO NOT MEASURE THE INVENTION

It has already been noted in connection with the issues of nonobviousness and inventorship that all four of the patentees at one time or another considered a reduced impact pressure of the jet on the bath or the avoidance of a deep penetration of the bath by the jet to be the gist of their invention. (Rinesch affidavit DX 116; Hauttmann affidavit DX 117; R. 2772-73; Trenkler testimony R. 11,904, 11,912 and 11,942; Suess Austrian application PX 2C; U. S. continuation-in-part application PX 2A, claims 1-4; and the German File Wrapper History PX 93B, pp. 31-32 and 41.) For example, Dr. Trenkler defined the invention as follows:

> "A. *In our method we blow only on the surface and a little below.* I do not think I can state that very shortly. It will be about two to three sentences.

"Q. All right.

[103] "A. *Owing to this type of blowing to the upper regions of the bath,* we have an essentially earlier dissolution of the lime, a higher Fe content in the slag, and thereby a faster and better dephosphorization. Owing to the fact that the hot zone caused by the top blowing of oxygen is not deep in the bath, the lining is protected. The third and the last sentence comes now.

"Q. Go ahead.

"A. Owing to the fact that the phosphorus content, that is, the phosphorus burns earlier, that is, prior to the combustion of carbon, we have until the end of the process a carbon monoxide evolution which results in an essentially better movement of the bath than the one that would be caused by the oxygen jet." (R. 11,904. Emphasis supplied.)

The specification of the patent in suit teaches the avoidance of deep penetration as an essential characteristic of the process of the patent. (Col. 3, lines 46, 74; col. 4, line 70, col. 9, line 18.) Further, plaintiffs in this litigation have repeatedly contended that the "new mental concept" that differentiates the invention of the patentees from the prior art Schwarz and Miles patents, and also the teachings of Dr. Durrer and Dr. Hellbruegge, was a reduction in impact pressure so as to avoid the deep penetration suggested by the prior teachings. (See e.g. Plaintiffs' main brief, pp. 37 to 43; reply brief, p. 27; final argument R. 13,184-88; 13,214; 13,269-79.)

At R. 13,187-88, counsel for plaintiffs said:

"They [the patentees] learned that you have to avoid the deep penetration; . . . in other words, they had to reduce the impact pressure.

* * *

". . . They arrived at this thought: 'That maybe we've got to blow this from a higher point. Maybe we've got to cause this oxygen to impinge on the surface of the bath with a lower impact pressure and avoid stirring the bath by the oxygen stream, so what we'll do is to use another nozzle, and we'll also raise the lance further above the bath level.' "

[104] Additionally, at R. 13,769-70, the following colloquy occurred:

"*[Counsel for Plaintiffs]*: The gist of the affidavits, I would say, your Honor, is, if I may summarize it rather quickly, that the primary difference between the L-D process and the process of Schwarz and Miles, which never got anywhere, is that in both Schwarz and Miles they teach deep penetration as a necessity, whereas in the L-D process you avoid deep penetration.

"*The Court*: Isn't that the real gist of the difference between the patent in suit and Schwarz and Miles? Isn't that the real gist?

"*[Counsel for Plaintiffs]*: Yes, your Honor.

"*The Court*: Of the difference?

"*[Counsel for Plaintiffs]*: Yes, your Honor. And that is the thing which is stated here in the affidavits, and the affidavits do not point out that it was a new kind of nozzle, a different kind of

nozzle that is the crux of the invention. The affidavits point out that the crux of the invention was reducing the pressure of the oxygen on the melt so that you did not have this deep penetration.

"*The Court*: That would be the advance in the art, then, over Schwarz and Miles?

"*[Counsel for Plaintiffs]*: I think that is an important feature of it, as I indicated earlier.

"*The Court*: Are there any others?

"*[Counsel for Plaintiffs]*: Beg pardon?

"*The Court*: Are there any others?

"*[Counsel for Plaintiffs]*: Well, I think, as I pointed out the other day in our main brief, we pointed out a number of other distinctions between Schwarz and Miles—

"*The Court*: But that is the main difference?

"*[Counsel for Plaintiffs]*: Yes."

Also, plaintiffs' proposed finding of fact No. 31 speaks of the "new concept of non-deep penetration." There is no question on the state of this record that plaintiffs have repeatedly [105] stated the avoidance of deep penetration of the bath by the oxygen jet to be the gist of their invention. Indeed, such a position was essential to rebut the defenses of anticipation, obviousness and non-inventorship. Plaintiffs, having taken this position as to the true nature of the invention to rebut such defenses, are now bound by their position, which, as already discussed at length, is well-supported by the evidence in the record.

For a valid patent, Section 112 requires a statement of claim or claims which particularly point out and distinctly claim the subject matter which the applicants regard as their invention. In the instant case, the avoidance of deep penetration is clearly the subject matter which applicants regarded as their invention, and yet the concept of the avoidance of deep penetration simply cannot be read into the claims of the patent in suit. The language of the claims admittedly does not refer expressly to the avoidance of deep penetration of the bath by the jet (R. 13,772), nor can any language of the claims be construed to contain such a meaning.

The claims of the patent in suit speak of "discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath at the central portion thereof." Such language is clearly not restricted to a non-deep penetration and could include a penetration far below the surface of the bath.

Plaintiffs rely on language in the claims referring to the avoidance of "material agitation of the bath by the oxygen stream" and "a localized reaction zone spaced a substantial distance from the refractory lining" as incorporating the concept [106] of the avoidance of deep penetration. (R. 13,772-73.) However, these references cannot be so construed.

On the state of this record, this Court is obliged to conclude that the avoidance of deep penetration by the jet is not necessarily causally related to the claim of avoiding "material agitation of the bath by the oxygen stream." In other words, it appears to this Court that even deep penetration would avoid material agitation as defined by plaintiffs. The lack of any causal relation

between deep penetration and material agitation by the jet, or at least the lack of any showing of such relation in this record, will be discussed fully in another connection. (See *infra* II. E. (2) (a).) It is sufficient at this point to observe that no such causal relation has been established in this record that would entitle plaintiffs to read the avoidance of deep penetration into the language of the claims referring to the avoidance of material agitation of the bath by the oxygen stream.

As for the "localized reaction zone spaced a substantial distance from the refractory lining," such a reaction zone could also exist even with deep penetration. Indeed, the Schwarz and Miles patents which taught deep penetration also referred at least indirectly to the existence of such a reaction zone a substantial distance from the refractory lining. (DX 61, Schwarz, pp. 4-5; Miles, pp. 3, 15, 16.) Deep penetration of the bath by the oxygen jet as taught by Schwarz and Miles might well extend to a depth of two-thirds of the bath, for example, still leaving a "substantial distance" of one-third of the bath depth between the reaction zone and the refractory lining. The term "substantial distance" is not given any definite meaning by the patent [107] in suit, and the patent certainly does not teach that one-third of the bath depth, for example, would not be a "substantial distance" within the meaning of the claims. Thus plaintiffs cannot read the avoidance of deep penetration into the language of the claims referring to "a localized reaction zone spaced a substantial distance from the refractory lining."

There is a further reason why the actual invention of the patentees cannot be read into the claims of the

patent in suit. Claims 1 through 4 of the continuation-in-part application, which expressly mentioned the avoidance of deep penetration as an essential feature of the claimed invention, were rejected by the Patent Office and later cancelled by the applicants. (PX 2A.) Instead of pressing claims which expressly mentioned the avoidance of deep penetration by resubmitting such claims and eventually even appealing further rejections, if necessary, the applicants abandoned the use of language referring to the avoidance of deep penetration and later chose to submit the language of the claims as finally approved by the Patent Office, resulting in the issuance of the patent in suit. Therefore, the well-established doctrine of file wrapper estoppel prohibits a construction of the claims finally approved by the Patent Office as containing a concept expressed in language previously rejected by the Patent Office and then abandoned by the applicants. As the Supreme Court stated in *Schriber-Schroth Co. v. Cleveland Trust Co.*, 311 U.S. 211, 220-21 (1940):

> "It is a rule of patent construction consistently observed that a claim in a patent as allowed must be read and interpreted with reference to claims that have been cancelled or rejected, and the claims allowed cannot by construction be read to cover what was thus eliminated from the patent. [108] *Shepard v. Carrigan*, 116 U. S. 593; *Sutter v. Robinson*, 119 U. S. 530; *Roemer v. Peddie*, 132 U. S. 313; *Phoenix Caster Co. v. Spiegel*, 133 U. S. 360; *Hubbell v. United States*, 179 U. S. 77; *Weber Electric Co. v. E. H. Freeman Electric Co.*, 256 U. S. 668; *I.T.S. Rubber Co. v. Essex Rubber Co.*, 272 U.S. 429, 443. The patentee may not, by resort to the

doctrine of equivalents, give to an allowed claim a scope which it might have had without the amendments, the cancellation of which amounts to a disclaimer. *Smith v. Magic City Club,* 282 U. S. 784, 790; *Weber Electric Co. v. E. H. Freeman Electric Co., supra,* 677, 678; *I.T.S. Rubber Co. v. Essex Rubber Co., supra,* 444. The injurious consequences to the public and to inventors and patent applicants if patentees were thus permitted to revive cancelled or rejected claims and restore them to their patents are manifest. See *Leggett v. Avery,* 101 U.S. 256, 259.

"True, the rule is most frequently invoked when the original and cancelled claim is broader than that allowed, but the rule and the reason for it are the same if the cancelled or rejected claim be narrower. *Morgan Envelope Co. v. Albany Paper Co.,* 152 U. S. 425, 429; *Wm. B. Scaife & Sons Co. v. Falls City Woolen Mills,* 209 F. 210, 213; see *Computing Scale Co. v. Automatic Scale Co.,* 204 U. S. 609, 620, 621; cf. in case of disclaimer *Altoona Publix Theatres, Inc. v. Tri-Ergon Corp.,* 294 U. S. 477, 492, 493."

It is unfortunate that the applicants adopted a course of conduct in the prosecution of their continuation-in-part application which resulted in the creation of such an estoppel. This Court is convinced on the state of this record that the "new mental concept" of the patentees to avoid a deep penetration of the bath by the jet was a patentable advance in the art of steelmaking, which explains the adoption of the Linz oxygen steelmaking process by steelmakers throughout the

world. Thus, if the applicants had pressed their claim of avoidance of deep penetration in the Patent Office, so as to particularly point out and distinctly claim the subject matter which the applicants actually regarded as their invention, a valid patent might well [109] have issued. In actual fact, however, the subject matter which the applicants regarded as their invention cannot be read into the language of the claims of the patent in suit and, therefore, the claims do not comply with the requirements of Section 112 for failure to particularly point out and distinctly claim the actual invention of the patentees. "The omission of an indispensable step of a process renders a claim invalid." *Technograph Printed Circuits, Ltd., v. Bendix Aviation Corp.*, 218 F. Supp. 1, 44 (D. Md. 1963), affirmed 327 F. 2d 497 (CA 4, 1964), cert. den. 379 U. S. 826 (1964); citing *Aluminate Co. v. Akme Flue, Inc.*, 50 F. 2d 921 (D. Md. 1931); *Daniel Green Felt Shoe Co. v. Dolgeville Felt Shoe Co.*, 210 F. 164 (CCA 2, 1913); *Pennsylvania Crusher Co. v. Bethlehem Steel Co.*, 193 F. 2d 445 (CA 3, 1951); *Western States Machine Co. v. S. S. Hepworth Co.*, 147 F. 2d 345 (CA 2, 1945), cert. den. 325 U. S. 873 (1945). See also *Ideal Roller & Mfg. Co. v. Sutherland Paper Co.*, 96 F. 2d 675, 677 (CCA 6, 1938). Since the avoidance of deep penetration is clearly an indispensable step and indeed the very gist of the invention, its omission from the claims of the patent in suit renders the claims invalid and the patent in suit must, therefore, be held invalid for this reason alone.

(2) THE CLAIMS ARE NOT SUPPORTED BY THE SPECIFICATION

The claims of the patent in suit are a classic example of what Mr. Justice Fortas in the recent case of *Brenner v. Manson,* 383 U. S. 519, 534 (1966), described as "the highly developed art of drafting patent claims so that they disclose as little useful information as possible — while broadening the scope of the claim as widely as possible." But it is a well-established [110] principle of patent law that the claims of a valid patent must be supported by the specification. As the Supreme Court said in *Schriber-Schroth Co. v. Cleveland Trust Co.,* 305 U. S. 47, 57 (1938):

> "The object of the statute is to require the patentee to describe his invention so that others may construct and use it after the expiration of the patent and to 'inform the public during the life of the patent of the limits of the monopoly asserted, so that it may be known which features may be safely used or manufactured without a license and which may not.' *Permutit Co. v. Graver Corporation,* 284 U. S. 52, 60. It follows that the patent monopoly does not extend beyond the invention described and explained as the statute requires, *Permutit Co. v. Graver Corporation, supra, at* 57; that it cannot be enlarged by claims in the patent not supported by the description, *Snow v. Lake Shore & M. S. Ry. Co.,* 121 U. S. 617; cf. *Smith v. Snow,* 294 U. S. 1; and that the application for a patent cannot be broadened by amendment so as to embrace an invention not described in the application as filed, at least when adverse rights of the

public have intervened. *Railway Co. v. Sayles,* 97 U. S. 554, 563, 564; *Powers-Kennedy Corp. v. Concrete Co.,* 282 U. S. 175, 185-186; cf. *Webster Electric Co. v. Splitdorf Electrical Co.,* 264 U. S. 463; *Permutit Co. v. Graver Corporation, supra; Crown Cork & Seal Co. v. Gutmann Co.,* 304 U. S. 159."

In the instant case, several steps of the claims of the patent in suit are not supported by the specification, as required.

(a) *The avoidance of "material agitation of the bath by the oxygen stream"*

The term "material agitation" or "avoidance of material agitation" is admittedly not used or defined in the specification of the patent in suit. (R. 13,326, 13,-327, 13,328; also plaintiffs' main brief, p. 190; Dr. Chipman, R. 879; Dr. Elliott, R. 6627; Dr. Hauttmann, R. 2412.) For example, when Dr. Chipman was asked: "Do you find any teaching anywhere in the patent of [111] the avoidance of material agitation by the oxygen stream during the blow?", he finally answered: "I must reply that I do not know, but that I have been unable in the time I have spent here to locate it." (R. 877-78.)

Also, at R. 880, the following exchange occurred:

"Q. . . . do you find any teaching in the patent of what is material agitation, or material agitation produced by the oxygen stream, physically?

"A. I see no definition of it.

"Q. You don't know from anything in the patent when a harmless agitation becomes a material agitation, do you, Doctor?

"A. I don't think so."

After Dr. Chipman testified that the patentees advised against material agitation by the jet, he was asked the location of such teaching and replied:

"A. It is illustrated in the claims. Whether it is elsewhere, I don't know.

"Q. That's pretty important, Doctor. Do you want to look a little further?

"A. No. It is either there or it isn't.

"Q. Well, is it? You have qualified as an expert on this patent. I want your answer.

* * *

"A. The advice is implied rather than explicit.

"Q. You can't find any such advice, can you, Doctor?

"A. No, not explicit." (R. 886-87.)

Plaintiffs attempted to avoid the effect of such omission by citing the case of *A. S. Boyle Co. v. Harris-Thomas Co.*, 18 F. Supp. 177, 181 (D. Mass. 1937) for the proposition that "The patentee is not bound to use in his claims the precise [112] phraseology with which he sets forth the invention in his specification." It is true that the same "precise phraseology" is not required, but there must be at least some antecedent language in the specification to support the claim. No such language can be found in the specification of the patent in suit.

There is only one reference in the specification which appears to this Court to relate to the claim of avoidance of material agitation of the bath by the oxygen stream. As already mentioned, at col. 6, lines 66 to 72, the patent teaches that at the end of the blow, when carbon combustion has been completed, "the bath becomes relatively quiet," and "the turbulence of the

bath and slag due to the oxygen stream impinging from directly above is insufficient to cause continuance of oxygen-metal reactions." Plaintiffs rely on such quieting of the bath at the end of the blow as evidence of the avoidance of material agitation of the bath by the jet. (E.g., main brief, pp. 262-68.) Such reference in the specification to the quieting of the bath would give only a very restricted meaning to the concept of avoidance of material agitation. Under the teaching of such reference, the material agitation of the bath to be avoided would be that amount of agitation by the jet which would suffice to prevent quieting of the bath or to cause continuance of oxygen-metal reactions at the end of the blow when carbon combustion has been completed. The Court can attribute no more meaning than this to the language of the claims concerning the avoidance of material agitation, at least on the basis of the teaching of the specification. And since, as a matter of fact, it has not been established that there could ever actually be an agitation by the jet that would prevent such quieting of the bath at the end of the [113] blow, the avoidance of material agitation so defined would appear to be inevitable.

In support of the claim of avoidance of material agitation, plaintiffs also rely upon the teaching of the specification in col. 3, lines 37 to 40, that the jet is blown vertically downward upon the central portion of the bath. According to the undisputed testimony of Dr. Elliott (R. 6162) and also Dr. Chipman (R. 1066), such positioning of the lance results in the least possible amount of agitation of the bath by the oxygen stream. In other words, any other placement of the lance, either

at an angle or off center, would increase the agitation of the bath by the mechanical action of the oxygen stream. Such teaching of vertical blowing does not provide adequate support for the claim of avoidance of material agitation by the jet, since the teaching of vertical blowing toward the center of the bath is itself expressly referred to in the claims by the language: "discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath at the center portion thereof." Therefore, if the concept of avoidance of material agitation were supported only by the teaching of vertical blowing at the bath center, the language of the claims concerning avoidance of material agitation would be merely surplusage. Further, it is clear from the claims that the language concerning avoidance of material agitation must be read with reference to penetration by the jet, rather than placement of the lance, since the claim speaks of blowing "onto and below the surface . . . to an extent to avoid material agitation of the bath by the oxygen stream."

[114] Plaintiffs find primary support for the claim of avoidance of material agitation by the oxygen stream in the teaching of the specification to avoid deep penetration, relying on the testimony of Dr. Elliott, a Professor of Metallurgy at Massachusetts Institute of Technology who testified for plaintiffs, that the avoidance of deep penetration results in the avoidance of material agitation of the bath by the jet (R. 6162-66.) However, plaintiffs have admitted that the specification does not expressly teach any such correlation. In final argument, for example, the following colloquy occurred:

"*[Counsel for Plaintiffs]*: . . . And then we have the teaching in regard to the avoidance of deep penetration.

* * *

"And, of course, where you avoid deep penetration you avoid this material agitation of the bath by the oxygen stream.

"*The Court*: Yes, that is what you say. That is true. But the specification doesn't use that language.

"*[Counsel for Plaintiffs]*: That is correct.

"*The Court*: It doesn't say that if you avoid deep penetration that material agitation would be avoided. It doesn't say that in so many words.

"*[Counsel for Plaintiffs]*: That is correct, your Honor." (R. 13,329.)

According to Dr. Elliott's testimony (R. 6638-42), the specification of the patent in suit teaches a correlation between the avoidance of deep penetration and the avoidance of material agitation at six different places. The Court concludes on examination of the six references cited by Dr. Elliott, and hereinafter referred to, that no such correlation is in fact taught by the specification. At col. 3, lines 37 to 50, the [115] patent teaches only vertical blowing without deep penetration so as to produce "a relatively confined zone of direct oxygen to molten metal contact with respect to the total surface area of the bath." Agitation of the bath by the jet is not mentioned. At col. 4, lines 26 to 38, the patent teaches only that vertical blowing brings about a circulation of the bath down in the center away from the

localized reaction zone. Again, agitation of the bath by the jet is not mentioned. At col. 4, lines 54 to 67, the patent teaches that agitation of the bath caused by chemical reactions in the localized reaction zone augments a pre-existing circulation of the bath brought about by the jet. Agitation of the bath by the jet is again not mentioned or said to be insignificant in comparison with agitation caused by chemical reactions. At col. 6, lines 69 to 73, the patent teaches that once carbon combustion is completed, "The turbulence of the bath and slag due to the oxygen stream impinging from directly above is insufficient to cause continuance of oxygen-metal reactions." This language is the sole reference in the specification of the patent to an agitation of the bath by the jet. In this reference, no mention is made of the depth of penetration. Certainly this reference does not expressly teach that only the avoidance of deep penetration results in the avoidance of material agitation of the bath by the oxygen stream. No causal relation between deep penetration and material agitation is taught. The other two references cited by Dr. Elliott at col. 9, lines 6 to 14, and in col. 10 of the patent specification, merely give some exemplary blowing information for heats making good steel, and the references teach nothing expressly about either penetration or agitation by the jet.

[116] Thus on close examination, none of the references relied on by plaintiffs teach any causal relation between deep penetration and material agitation by the oxygen stream. Plaintiffs merely assume that the two concepts are causally related. However, if such an assumption is not taught by the specification itself, then persons skilled in the art of steelmaking reading the pat-

ent are not informed of the meaning of language in the claim referring to the avoidance of material agitation by the oxygen stream.

Further, as already discussed, the doctrine of file wrapper estoppel prevents a reading of the claim of avoidance of material agitation as supported by the specification's teaching of avoidance of deep penetration, since claims previously submitted by the applicants which had expressly referred to the avoidance of deep penetration were rejected by the Patent Office and later cancelled. (PX 2A.)

Significantly, no causal relation between the avoidance of deep penetration and the avoidance of material agitation was expressed anywhere in the file wrapper history of the patent in suit until June 11, 1957, when the affidavits of Dr. Rinesch and Dr. Hauttmann (DX 116, 117) were filed in the Patent Office. On the same date, the language of the claims concerning the avoidance of material agitation by the oxygen stream was presented to the Patent Office for the first time. The affidavits and the new language of the claims were clearly submitted to the Patent Office in response to its rejection of previous claims in light of the Miles patent, which taught that the jet agitated the bath. (DX 61, Miles, p. 18.) The language of the new claims concerning the avoidance of material agitation was, therefore, an obvious attempt [117] to distinguish the Miles patent. In a letter to the Patent Office submitted together with the affidavits and the new claims, counsel for the applicants stated:

"It will be appreciated that the conditions of the reaction and for practicing the method are very

> different, indeed, from anything shown in the prior art and particularly the process disclosed in the Miles et al. French patent." (PX 2A, p. 77.)

At the time the new claims were submitted, no changes were made in the specification.

Plaintiffs contend that the specification must be construed in light of what it would teach persons skilled in the art, and argue further that persons skilled in the art of steelmaking would know what was meant by the language of the claims referring to the avoidance of material agitation by the oxygen stream. In this regard, it is unquestionable that the sufficiency of a specification in a patent application must be tested in light of what it conveys to those who are skilled in the pertinent art at the time the invention was made, *Application of Wilke,* 314 F. 2d 558, 565 (C.C.P.A. 1963).

The evidence established that the concept of avoidance of material agitation of the bath by the jet would not have been meaningful to persons skilled in the art at the time the invention was made. The Schwarz and Miles patents do not mention the concept of "material agitation" and neither patent teaches any causal relation between deep penetration and material agitation. The Miles patent does teach that the jet agitates the bath (DX 61, Miles, p. 18) but does not expressly teach deep penetration. Certainly Miles does not teach that *only* deep penetration would agitate the bath materially. Thus, even if the contenton of the [118] Rinesch and Hauttmann affidavits in 1957 that only deep penetration causes material agitation were accepted by this Court, the patent teaching of the avoidance of deep penetration would still not suffice under Section 112 to support the

claim of avoidance of material agitation, since persons skilled in the art of steelmaking at the time the invention was made reading the patent would not be aware of any such causal relation and would, of course, not be responsible for knowing the contents of affidavits filed more than seven years later.

Further, plaintiffs have defined material agitation by the jet as agitation sufficient to overcome circulation created by chemical reactions. (Main brief, pp. 191-92; R. 13,331-32. See also Dr. Chipman, R. 889-900A, 1064, 1066; Dr. Elliott, R. 6167.) However, there is no evidence that in 1950, a circulation induced by chemical reactions was known to persons skilled in the art, or at least taught by the prior art. Neither the Schwarz nor the Miles patent teaches a circulation or agitation of the bath produced by chemical reactions or the direction of any circulation of the bath. Indeed, the concept of reaction-induced circulation would not necessarily be recognized by persons skilled in the art even today, for it is not clearly taught by the specification of the patent in suit and there was disagreement in the expert testimony at trial as to its existence. In any event, if reaction-induced circulation were not known to persons skilled in the art at least in 1950, the concept of material agitation by the oxygen stream which would overcome such circulation would also have been unknown to such persons.

In addition, persons skilled in the art who testified for plaintiffs did not seem to know what the language of the [119] claims referring to material agitation meant or to be able to tell when the conditions of such agitation or its avoidance would exist. For example, when Dr.

Hauttmann, one of the patentees, was asked: "How would an operator practicing oxygen blowing tell when the agitation produced by the jet became material?", he answered: "I do not know that." (R. 2414.) When Mr. Prince, a metallurgical engineer employed by plaintiff Kaiser, was asked: "When does agitation become material?", he finally replied: "I don't know, Mr. Groner. It is just when agitation becomes material." (R. 5784.) Also, when Dr. Chipman was asked: "You don't know from anything in the patent when a harmless agitation becomes a material agitation, do you, Doctor?", he replied: "I don't think so." (R. 880.)

Thus this Court concludes that the claim step of avoidance of material agitation of the bath by the oxygen stream is not supported by the specification of the patent in suit except in a very limited and perhaps meaningless way, and could not have been a meaningful concept to persons skilled in the art at the time the invention was made, especially since the concept did not appear very meaningful to some of plaintiffs' expert witnesses even at the trial roughly fourteen years later.

This Court is further persuaded on the basis of plaintiffs' own testimony that the concept of material agitation of the bath by the oxygen stream is purely fictional, since plaintiffs' own testimony strongly suggests that materal agitation by the jet could not be achieved even with deep penetration. Dr. Ascher H. Shapiro, a professor of Mechanical Engineering at Massachusetts Institute of Technology, a witness for plaintiffs, [120] testified that the force of chemical reactions which would tend to create a downward circulation in the center of the bath would be roughly 3,000 times

stronger than the force of the jet blowing vertically from above (R. 3772-73; PX 267), and that the "power" of such reactions would be more than 8,000 times stronger than that of the jet. (R. 3801; PX 272.) In view of the tremendous force of chemical reactions agitating the bath and initiating a circulation downward in the center of the bath as compared with the relatively feeble agitating power of the jet, it seems impossible that a deep penetration by the jet could overcome or even materially affect such circulation, so as to cause a material agitation by the oxygen stream.

Dr. Shapiro's testimony was confirmed, in effect, by Dr. Elliott (R. 6280), and also Dr. Chipman, who apparently concluded that there could be no such thing as material agitation of the bath by the oxygen stream when making steel by an oxygen top blowing process. Specifically Dr. Chipman testified:

> "The teaching that I find in the patent wth respect to agitation leads me to conclude and understand that the agitation which is present in actuality is far greater than the agitation by the oxygen stream, compared to which the agitaton of the oxygen stream becomes immaterial." (R. 880.)

Also, when he was asked:

> "If a manufacturer, a steel maker, came to you as an expert and asked you how much agitation he would have produced by the oxygen stream and still stay outside the patent, what would you advise him?"

Dr. Chipman replied:

> ". . . I would say, however, that he would not be able to get oxidation by the oxygen stream—agita-

tion by the oxygen stream. He would not get agitation by the oxygen stream of the molten metal. . . . He would never see the agitation that he [121] gets. He would never know that the oxygen stream was doing any agitating, because there are so much more active forces— . . . agitating . . ." (interrupted). (R. 880-81.)

Dr. Chipman defined material agitation negatively as follows:

"If there are other sources of agitation which overshadow the agitation of the simple action of the gas on the metal, then I think you do not have material agitation." (R. 889.)

He continued to speak of agitation by the oxygen stream, stating:

"You know that by comparison with other phenomena, it is very small." (R. 900. See also R. 879, 886-87, 1065-66.)

Significantly, plaintiffs admit that there is no evidence in the record that deep penetration would, in fact, cause material agitation. On final arguments, the following discussion occurred:

"*The Court*: Then if there is in fact the deep penetration, like under Schwarz and Miles, or, as you claim, under Durrer and Hellbruegge—if there is in fact deep penetration, does the agitation of the bath caused by deep penetration overcome the circulation caused by the chemical reactions?

"*[Counsel for Plaintiffs]*: I don't know whether that would be the exact case when you are blowing under those circumstances—that is, blowing very deeply into the bath. I don't know whether the me-

chanical action would be supreme or what the effect would be. I don't believe it's covered by the evidence." (R. 13,332-33.)

Likewise, Dr. Chipman testified that he did not know whether, in fact, deep penetraton would cause agitation of the bath. (R. 949-51.) And Dr. Hauttmann testified that he had had no experience regarding deep blowing from above. (R. 2519.)

There is, moreover, tangible evidence in the record tending to confirm that the concept of material agitation by the oxygen stream is a fiction. During the trial of this litigation, defendant's witnesses conducted an oxygen steelmaking demonstration (No. 7) in the presence of this Court in the Cast Metal [122] Laboratories of the University of Michigan at Ann Arbor. Demonstration No. 7 involved a deep penetration of the metal bath by the oxygen jet, as established by damage to the refractory bottom visible after the heat was concluded and the converter was emptied of molten metal. Portions of the demonstration were recorded in a movie (DX 162D) viewed by the Court both during and after the trial. During the major part of the blow as shown in the movie, large amounts of slag and metal were thrown up and out of the converter onto the floor, indicating a violent agitation of the metal bath. However, during the last few seconds of the blow when the chemical reactions in the bath had subsided, there was no throw-out whatever, although the blowing pressure of the oxygen jet, according to a gauge visible in the movie, remained at forty pounds per square inch, at which pressure considerable throw-out of metal and slag had previously occurred. In other words, the agitation of the bath as shown by the throw-out subsided near the

end of the blow, although the action of the oxygen jet remained constant. If the bath agitation causing such throw-out of metal and slag had been caused by the mechanical action of the oxygen stream alone, the throw-out would not have ceased as it did near the end of the blow. It is obvious, therefore, that the action of the oxygen stream alone was not responsible for the agitation of the bath causing throw-out of metal and slag during the major part of the blow. Plaintiffs rely heavily on such quieting of the bath at the end of the blow in defendant McLouth's steelmaking operations as evidence that McLouth avoids "material agitation of the bath by the oxygen stream". Applying plaintiffs' own argument, "material agitation of the bath by the oxygen stream" was also avoided in demonstration No. 7 despite deep [123] penetration of the bath by the oxygen jet. But if material agitation by the oxygen stream is avoided even with deep penetration, then the concept of material agitation by the oxygen stream is clearly a fiction, since such agitation is apparently always avoided when blowing vertically, regardless of the depth of penetration.[8] Demonstration No. 7 illustrates that

8. It should be noted that in another of defendant's demonstrations to the Court in Ann Arbor, Michigan, No. 5, no refractory damage occurred and good steel was made without an afterblow, which suggested an avoidance of deep penetration within the meaning of the specification of the patent in suit. In demonstration No. 5, as well as in demonstration No. 7, the bath quieted down at the end of the blow, as shown by the disappearance of throw-out in the movie (DX 160D) recording portions of the demonstration. Thus, applying plaintiffs' argument, material agitation of the bath by the oxygen stream was avoided in demonstrations involving both deep and non-deep penetration of the bath by the jet.

even with deep penetration of the bath by the jet, such agitation of the bath as may occur results from chemical reactions rather than the mechanical action of the oxygen jet upon the bath. But if deep penetration as well as non-deep penetration fails to bring about an agitation of the bath by the oxygen stream, as in demonstration No. 7, then there can be no logical correlation between the avoidance of deep penetration and the avoidance of material agitation of the bath by the oxygen stream. It follows that the teaching of the specification to avoid deep penetration does not provide support for the language in the claims of the patent in suit "to avoid material agitation of the bath by the oxygen stream."

Dr. Elliott was the witness at trial upon whom plaintiffs primarily relied to establish support for the claim step of avoidance of material agitation by the jet. He defined the avoidance of material agitation by reference to the formation [124] of an early fluid slag during the blow, production of steel low in phosphorus, and the avoidance of refractory damage. (R. 6167.) Dr. Elliott similarly defined avoidance of deep penetration with reference to the same three factors. (R. 6169.) Thus his definitions apparently represent an attempt to equate material agitation with deep penetration. However, as already noted, the specification of the patent in suit does not teach any such correlation between the two concepts, and in fact the doctrine of file wrapper estoppel prohibits any such construction of the claim, since claims previously submitted expressly referring to the avoidance of deep penetration were rejected and then cancelled by the applicants. (PX 2A.) Moreover, demonstration No. 7, along with other evidence already dis-

cussed, established a lack of any correlation between the two concepts in fact, since such evidence indicates that material agitation by the jet will be avoided even with deep penetration by the jet. Dr. Elliott himself relied on the quieting of the bath at the end of the blow as in demonstration No. 7 as a sign of avoidance of material agitation of the bath by the oxygen stream. (R. 6278-79.)

Even assuming that the Court could accept Dr. Elliott's equation of material agitation with deep penetration, the meaning of material agitation would still not be adequately clarified, since even the concept of deep penetration does not acquire a clear or consistent meaning from Dr. Elliott's testimony. For example, he testified that deep penetration causes an up in the center circulation, which may cause refractory wear on the walls near the bath surface. (R. 6146-56; PX 349.) However, he later testified that deep penetration causes bottom damage to the refractory (R. 6166) as the result of a downward moving stream of [125] hot metal in the center of the bath. (R. 12,340-43, 12,363.) Clearly, circulation cannot be both up and down in the center at the same time.

In addition, Dr. Elliott gave inconsistent definitions of deep penetration, as illustrated by defendant's demonstration No. 9 to the Court in May, 1964, at Ann Arbor Michigan. In demonstration No. 9, a hole was burned through the bottom of the refractory, permitting the molten metal in the converter to run out into a pan beneath the converter. (See movie, DX 164D.) Dr. Elliott defined deep penetration by reference to such bottom damage (R. 6168-69), testifying also that "deep pene-

tation arises when the jet enters more than, say, 35 to 40 per cent of the bath depth." (R. 6637.) From this testimony it seems that Dr. Elliott would have regarded the penetration in demonstration No. 9 as being at least 35 to 40 per cent of the bath depth. Yet he later testified that the penetration of the jet in demonstration No. 9 was no more than 1.5 inches of a 6.8 inch bath depth, or approximately 22 per cent of the bath depth (R. 12,382, 12,610), using Dr. Shapiro's correction factor of 0.233 to arrive at his estimate. (PX 231, 232.) Such contradictions appear to weaken Dr. Elliott's testimony with respect to the meaning of avoidance of material agitation by the oxygen stream.

Finally, the language in the claims concerning the avoidance of material agitation of the bath by the oxygen stream, although relied on by plaintiffs as a characteristic of the claims essential to novelty, appears under plaintiffs' own definition of the phrase to be mere surplusage in the claims. Plaintiffs take the position that material agitation by the jet is avoided unless [126] a down in center circulation induced by chemical reactions is overcome by the force of the jet. (E.g. main brief, pp. 191-94; R. 13,331-32.) But if such material agitation is avoided whenever a reaction-induced circulation is not overcome by the mechanical action of the jet, then the reference in the claims to the existence of a circulation induced by chemical reactions is the only language in the claims necessary to express the idea, and the language referring to the avoidance of material agitation by the jet is merely extraneous.

As previously stated, it appears to this Court that the real reason for the inclusion of language in the

claims of the patent in suit concerning the avoidance of material agitation by the jet was the desire by the applicants to distinguish the prior art Miles patent, which expressly taught that the jet itself agitated the bath. In effect, the specification of the patent in suit presented a new theory of agitation caused by chemical reactions, and the claims referred to an avoidance of agitation by the jet to give the impression of an entirely new steelmaking process. However, if material agitation by the oxygen stream is a fiction, as defendant's demonstration No. 7 and other evidence strongly suggest, then even under the process as taught by Schwarz and Miles, chemical reactions rather than the mechanical action of the jet must have been the actual cause of agitation in the bath. At least plaintiffs have failed to prove otherwise. And if the language of the claims of the patent in suit referring to the avoidance of material agitation covers the actual practice of steelmaking under the Schwarz and Miles patents, then plaintiffs can hardly rely on such language of the claims as a characteristic of the process essential to novelty. In other words, if Schwarz [127] and Miles avoided material agitation of the bath by the oxygen stream even with deep blowing, then such avoidance of material agitation by the oxygen stream cannot be considered a significant feature of the claims of the patent in suit.

(b) *Chemical reactions "producing a circulatory movement in the molten metal"*

The claim of a circulatory movement in the molten metal produced by chemical reactions in a localized reaction zone is simply not supported by the teachings of the specification of the patent in suit. References relied on by plaintiffs in this connection do not teach a circulation induced by chemical reactions. Col. 4, lines 26-38, teach, on the contrary, that

> "application of the oxygen jet substantially vertically or approximately vertically upon the central portion of the bath surface brings about a flow in the molten metal from the center of the surface of the bath downwardly and then along the bottom of the refining vessel, and upwardly at the sides of the vessel to the surface of the bath, so that portions of the unrefined metal are continuously presented to a localized center of direct oxygen reaction with the bath metal, while reacted or oxidized portions of the bath move away from this reaction center."

This language clearly refers to a circulation brought about by the application of the jet upon the bath surface. Chemical reactions are not mentioned in this reference as a factor in creating circulation, as Dr. Hauttmann, one of the patentees, admitted (R. 2515.)

Col. 4, lines 43-67, also relied on by plaintiffs, teach that

> "initial contact of the high purity oxygen jet with the molten metal bath causes a rapid combination of oxygen and iron to form FeO in the confined central reaction zone . . . [and that] A portion of

> the iron oxide goes to the slag with the other oxidized elements and a portion diffuses into the bath under the influence of the [128] bath circulation, so that within the first three minutes of the blowing vigorous carbon combustion is initiated due to the high temperatures developed by these reactions. The ensuing reaction of carbon with the FeO and directly with the oxygen gas in the confined direct oxidation zone causes rapid formation of carbon monoxide *and the formation of this CO causes a strong boil or agitation of the bath, which augments the bath circulation to continuously present unrefined metal to the oxygen gas reaction zone* and to create a slag-metal emulsion." [Emphasis supplied.]

This reference teaches that carbon monoxide formation causes a strong boil or agitation of the bath within the first three minutes of the blow, which "augments" the bath circulation already in existence brought about by the application of the oxygen jet as taught in col. 4, lines 28-34. The reference teaches that chemical reactions produce only an "agitation of the bath" rather than circulation, and that the agitation thus produced merely "augments" circulation already in existence.

> Col. 6, lines 62-72, also relied on by plaintiffs, state:
> "The vigorous boil, above mentioned, continues up to the carbon end point, and together with the induced circulation of the bath metal toward and away from the central zone of direct oxygen reaction, effectively counteracts any tendency to over-oxidation of the bath. When the flame dies and carbon combustion is completed, the bath becomes

relatively quiet and intimate contact between slag and metal bath ceases. The turbulence of the bath and slag due to the oxygen stream impinging from directly above is insufficient to cause continuance of oxygen-metal reactions."

This reference does *not* teach that when chemical reactions cease, circulation of the bath also ceases. Thus no casual connection is made explicit in this reference between chemical reactions and circulation. The reference does refer to "the induced circulation of the bath metal toward and away from the central zone of direct oxygen reaction." However, this language clearly refers back to the teaching of col. 4, lines [129] 28-34, of a circulation induced by the application of the jet to the bath surface. Such language cannot be read as teaching a circulation "induced" by chemical reactions, in light of the clear teaching of col. 4, lines 63-67, that chemical reactions cause only "a strong boil or agitation of the bath." The sentence at col. 6, lines 62-66, that mentions the "induced circulation" also refers to a "vigorous boil, above mentioned," which clearly refers back to the teaching of col. 4, lines 63-67, of a boil caused by chemical reactions that merely augments the pre-existing circulation brought about by the mechanical action of the jet.

Thus, none of the references in the specification relied on by plaintiffs teaches in so many words that circulation of the bath is produced by chemical reactions as claimed. The specification teaches a circulation brought about by the jet and merely augmented by a strong boil or agitation of the bath resulting from subsequent chemical reactions.

Plaintiffs also rely on a reference in the specification of the original patent application of Dr. Suess (PX 2B) to support the claim of reaction-induced circulation. This reference states:

> "In carrying out the present process as a refining treatment of iron with oxygen, upon blowing oxygen to the surface of molten iron, gas formation takes place by local reaction between the oxygen and the carbon present in the iron, and this gas formation causes strong movement in the molten bath. The reaction gases exert pressure in downward direction, because their escape in upward direction is checked by the pressure of oxygen and the presence of slag. Thus, a movement of the molten material in the direction of the gas stream results. The stream of molten material turns by 90° when reaching the bottom of the reaction vessel and moves finally in upward direction along the walls of the vessel." (PX 2B, pp. 3-4.)

[130] There is no such teaching in the specification of the continuation-in-part application which finally became the specification of the patent in suit and, therefore, the teaching of the original specification relied upon by plaintiffs must be considered as abandoned in the continuation-in-part application. In any event, there is no need to look beyond the specification of the patent itself because it is not ambiguous on this point. Incidentally, the reference in the original specification recites a theory of circulation inconsistent with the theory of circulation advanced by plaintiffs' expert witnesses at trial and is, therefore, not a teaching upon which plaintiffs would wish to rely very strongly.

Plaintiffs contend that the claim of reaction-induced circulation is supported by the teaching of the specification at col. 4, lines 32-34, of a circulation down in the center, which admittedly could only be caused by chemical reactions. (E.g., defendant's main brief, p. 52.) However, even though there may have been no dispute at trial that a down in the center circulation could only be brought about by chemical reactions, such is not the teaching of the specification. Col. 4, lines 26-38, already quoted, teach that a down in center circulation is brought about by the application of the oxygen jet and no mention is made of chemical reactions as a factor in initiating circulation.

Moreover, the teaching of a down in center circulation does not provide adequate support for the claim of a circulation induced by chemical reactions because the claim is not limited to any particular direction of circulation. Indeed, plaintiffs rely on the fact that the claim mentions no direction of circulation to justify a finding of infringement even if the Court [131] should find that the circulation in defendant's operations is a reaction-induced circulation up in the center. For example, at p. 385 of plaintiffs' main brief, it is stated:

> "McLouth does not dispute the fact that it obtains a circulatory movement in the bath in its operations. It does contend that the *direction* of circulation in its operation is the opposite of the direction of circulation taught in the *specification* of the Suess et al. patent (McLouth's Trial Brief, p. 101). However, the patent *claims* do not specify any direction of circulation. They specify merely the cause of the circulatory movement. Thus, even if

> the direction of the circulation is opposite to that set forth in the *specification,* it is of no consequence if the circulation is caused by the chemical reactions as specified in the clams." (Emphasis in original. See also R. 13,287.)

If the specification teaches only a down in center circulation, then the claim, which is not limited to any direction of circulation, would clearly overclaim the specification. As already noted, the Supreme Court in *Schriber-Schroth Co. v. Cleveland Trust Co.,* 305 U. S. 47, 57 (1938) stated:

> ". . . the patent monopoly . . . cannot be enlarged by claims in the patent not supported by the description . . ."

If plaintiffs were to argue in response to such conclusion that the claim is actually limited to a circulation down in the center because a reaction induced circulation can be *only* down in the center, such an assertion is certainly not taught by the specification, nor would it necessarily be known to persons skilled in the art even today. For example, the Cuscoleca patent, No. 2,803,534, which was issued August 20, 1957, teaches a circulation up in the center as a result of chemical reactions. (DX 68.) Certainly an allegation that circulation of a molten metal bath produced by chemical reactions could only be down in the center would not have been a fact known to persons skilled in the art in [132] 1950, since at that time there was no general knowledge among steelmakers of a reaction-induced circulation. An "explosive bubble" mechanism which would tend to justify a conclusion that reaction-induced circulation in a molten metal bath could only be down in the center was

advanced by Dr. Chipman and Dr. Shapiro for the first time at the trial of this litigation in 1963 and 1964 (R. 480-82, 490-92, 496-500, 3693-98), and was admittedly not contained in any literature prior to the time of trial. (R. 4250-51.)

In sum, plaintiffs are forced to engage in tortured construction of the specification and claims in the patent in suit in order to find support in the specification for a claim of reaction-induced circulation. In view of the relative ease with which such a claim could have been supported by even a sentence or two in the specification, this Court is unwilling to overlook plain language of the specification to find support for such claim.

(c) *Blowing "below the surface"*

At least thirteen separate references in the specification of the patent in suit speak of "surface blowing" or "blowing onto the surface," etc. But there is no reference anywhere in the specification to blowing "below the surface," as claimed. Col. 5, lines 61 and 62, speak of "the confined zone of direct oxygen *reaction at the surface* of the molten metal bath," (emphasis is added) which would seem to preclude a claim of blowing below the surface. Plaintiffs find support for the claim of blowing below the surface in the teachings of the specification to avoid deep penetration, and also defendant's admission (R. 854) that from such teachings "there may be implied some penetration." [133] However, the word "below" would seem to cover even a deep penetration of the bath by the oxygen stream, which is certainly not taught by the specification. The ambiguity of the word "below" in the claims would justify the Court in

looking beyond the patent itself to the file wrapper history to help resolve such ambiguity. As the Sixth Circuit Court of Appeals observed in *Robertz v. General Motors Corporation,* 228 F. 2d 94, 97 (1955), cert. den. 352 U. S. 824 (1956):

> "The claims of a patent are to be interpreted, not only in the light of the specifications, but also with reference to file-wrapper history."

The file wrapper history in this case (PX 2A) indicates that the language "below the surface" was added to the claims for the first time on June 18, 1957, only shortly before the patent was issued, and apparently in response to the rejection of previous claims of blowing "onto the surface" as unpatentable over prior art. Further, counsel for the applicants had previously argued to the Patent Office that the avoidance of deep penetration meant "a practically negligible penetration of the surface of the molten metal by the oxygen jet." (PX 2A, p. 68.) Under such definition, the teaching of avoidance of deep penetration in the specification would support a claim of blowing "below the surface" only to "practically negligible" degree. But even disregarding the file wrapper history, the Court concludes that the teaching in the specification of an avoidance of deep penetration is not adequate support for a broader claim of blowing "below the surface."

[134] (3) THE CLAIMS COVER PRIOR ART

The broad scope of the claims, as compared with the specification of the patent in suit, is demonstrated by the fact that according to plaintiffs' own testimony, the inference can fairly be drawn that even a person

practicing the prior art would infringe the process of the claims.

Blowing "onto and below the surface" is certainly taught by the Schwarz and Miles patents.

As for the avoidance of "material agitation of the bath by the oxygen stream," according to the testimony of Dr. Chipman, such agitation by the jet will always be avoided when blowing vertically because a far more powerful agitation of the bath caused by chemical reactions renders any agitation by the jet insignificant, regardless of the depth of penetration by the jet. For example, when asked:

> ". . . do you think anyone skilled in the art would have any difficulty in blowing in such a way as to avoid material agitation of the bath?"

Dr. Chipman replied:

> "He is going to blow in such a way to generate powerful chemical reactions which do a lot of agitating. He has to do this in order to operate the process. So he wouldn't have a bit of difficulty in setting up conditions where the chemical effects of CO evolution far over-shadow the effects of the direct agitation by the mechanical action of the oxygen stream." (R. 1064-65. See also *supra* II. E. (2) (a).)

As for the "localized reaction zone," Dr. Chipman defined such a zone as "the reaction in which the oxygen stream engages the metal."

The Court then inquired:

"It is anywhere the oxygen stream may engage the metal bath. Is that what you are saying?

[135] "A. Yes, your Honor." (R. 909.)

Dr. Chipman also testified that the localized reaction zone is a characteristic of the process which could not be avoided, even by blowing according to the teachings of Schwarz and Miles. Thus, at R. 1018, he was asked:

"Doctor, you have just admitted that if you blew according to Miles or according to Schwarz, so that you had penetration, you would have the hot spot in the cavity. That is correct, isn't it?

"A. Yes."

Also at R. 906-07, the following discussion occurred:

"Q. Well, do you mean that any time you jet oxygen onto a bath, you have in that fact alone answered this step of the claim?

"A. If a reaction occurs in the zone, yes.

* * *

"Q. I am trying to find out where the extent of the reaction zone is. Once more, suppose I am the manufacturer who wants to avoid this patent and I can avoid it by avoiding the localized reaction zone. Now, what do I do?

"A. You use another process.

"The Court. Use what?

"A. Another process. The localized zone is a characteristic of the process, and he cannot avoid it."

With regard to "high temperature," Dr. Chipman testified as follows:

"Q. . . . Now, do I understand from this that the hot spot develops at the bottom of the cavity made by the penetrating jet?

"A. All over the cavity.

"Q. And that occurs without regard to the depth of the cavity?

"A. Yes. The hot spot develops all over the cavity without regard to the depth.

[136] "Q. I take it that the hot spot you speak of there develops all over the cavity when you practice the teaching of Schwarz; is that so, Doctor?

"A. I think so.

"Q. You can't avoid it, can you?

"A. I don't think you can avoid it.

"Q. And it happens when you practice the teaching of Miles?

"A. Blowing oxygen onto and into the bath, you can't avoid the high temperatures." (R. 1016-17.)

With regard to the claim of a reaction-induced circulation, it is undisputed by the parties that a circulation of the molten metal bath down in the center could only be caused by chemical reactions and not the mechanical action of the jet. (E.g., defendant's main brief, p. 52.) Both Dr. Chipman and Dr. Elliott testified for plaintiffs that bottom damage in certain of defendant's tests involving deep penetration by the jet was caused by a downward moving stream of hot metal. (R. 635-36, 12,340-43.) However, if a steelmaker practicing

even deep penetration as taught by Schwarz and Miles has a down in center circulation which may result in bottom damage, then such a steelmaker must have a reaction-induced circulation as claimed by the patent in suit, even though he is practicing the prior art. Additionally, the testimony of plaintiffs' witnesses with respect to the tremendous force of chemical reactions creating a circulation down in the center would tend to suggest that even deep penetration as taught by the prior art would result in such down in center circulation. (E.g., R. 3772-73; PX 267; R. 3801; PX 272.)

[137] Dr. Hauttmann, one of the patentees testified that he had no actual experience regarding deep blowing from above (R. 2519, 2522), and that he merely assumed that the circulatory movement of the bath as taught by the prior art was up in the center. (R. 2524.) He finally admitted that he did not know the actual direction of circulation under prior teachings or whether it was in fact the same circulation as produced by the method of the patent in suit, stating: "We have no data on that." (R. 2772.) It would seem, therefore, that the distinction between the claims of the patent in suit and the prior art practice may well be a purely verbal one. In this connection, it must be noted that plaintiffs had considerable opportunity, both before and during the trial of this suit, to conduct steelmaking experiments that would illustrate a distinction, if any, between the process as claimed in the patent in suit and the practice of steelmaking under the Schwarz and Miles teachings of deep penetration. However, plaintiffs admittedly failed to come forward with evidence of any such experiments. (R. 13,332-33.)

(4) CONCLUSION ON CLAIMS UNDER § 112

In sum, it appears to this Court that when the applicants were faced with the rejection of claims accurately stating what they regarded to be their invention as unpatentable over the prior art, they unwisely abandoned such claims and instead substituted new claims which were accepted by the Patent Office. The new claims failed to point out the actual invention of the patentees, and, in addition, certain portions of the claims were not given adequate or meaningful support by the specification. At trial, certain of plaintiffs' witnesses candidly interpreted the claims of the patent in suit as being so broad that any [138] commercial steelmaking operation involving vertical blowing would necessarily infringe even if the operation were following prior art teachings, although the language of the new claims was clearly intended to distinguish the prior art patents. Such claims, if allowed, would flout the patent law of the United States.

It is well-settled that valid patent claims cannot claim more than the actual invention of the applicant. *Lincoln Engineering Co. v Stewart-Warner Corp.*, 303 U. S. 545, 549 (1938); *Holstensson v. V-M Corp.*, 325 F. 2d 109, 122 (CA 6, 1963); *Plax Corp. v. Precision Extruders*, 239 F. 2d 792, 795 (CA 3, 1957). As Mr. Justice Story stated as early as 1822 in *Evans v. Eaton*, 20 U. S. 356, 430:

> ". . . it is clear that the party cannot entitle himself to a patent for more than his own invention; and if his patent includes things before known, or before in use, as his invention, he is not entitled to

recover, for his patent is broader than his invention."

It is equally well-settled that valid patent claims cannot claim more than the specification discloses. *Schriber-Schroth Co. v. Cleveland Trust Co., supra,* 305 U. S. 47, 57 (1938); *Application of Holmen,* 347 F. 2d 852, 855 (C.C.P.A. 1965); *Del Francia v. Stanthony Corp.,* 278 F. 2d 745, 747 (CA 9, 1960); *Texas Co. v. Globe Oil & Refining Co.,* 225 F. 2d 725, 735 (CA 7, 1955).

Moreover, it is well-recognized that claims are too broad when they cover the prior art and are not confined to an applicant's advance in the art. *United Carbon Co. v. Binney & Smith Co.,* 317 U. S. 228, 236 (1942); *Huntman Stabilizer Corp. v. General Motors Corp.,* 144 F. 2d 963, 967 (CCA 3, 1944); *In re Oakes,* 140 F. 2d 669, 671 (C.C.P.A. 1944); *Heyer v. Brenner,* [139] 242 F. Supp. 538, 540 (D.C. Dist. of Col., 1965). As Mr. Justice Jackson stated in the *United Carbon Co.* case, *supra,* at 236-37:

> "The statutory requirement of particularity and distinctness in claims is met only when they clearly distinguish what is claimed from what went before in the art and clearly circumscribe what is foreclosed from future enterprise. . . . An invention must be capable of accurate definition, and it must be accurately defined, to be patentable."

In this connection, the Supreme Court commented in *Merrill v. Yeomans,* 94 U. S. 568, 574 (1876):

> "It seems to us that nothing can be more just and fair both to the patentee and to the public, than

> that the former should understand and correctly describe just what he has invented, and for what he claims a patent."

Further, the Supreme Court stated in *General Electric Co. v. Wabash Appliance Corp.*, 304 U. S. 364, 369 (1938):

> "The limits of a patent must be known for the protection of the patentee, the encouragement of the inventive genius of others and the assurance that the subject of the patent will be dedicated ultimately to the public. The statute seeks to guard against unreasonable advantages to the patentee and disadvantages to others arising from uncertainty as to their rights. The inventor must 'inform the public during the life of the patent of the limits of the monopoly asserted, so that it may be known which features may be safely used or manufactured without a license and which may not.' The claims 'measure the invention.' "

The claims of the patent in suit do not measure the invention of the applicants; they do not accurately define or correctly describe just what the applicants invented; they do not find adequate support in the specification; and they do not clearly distinguish what is claimed from what went before in the art. Therefore, the claims do not meet the requrements of 35 U.S.C. § 112, and the patent in suit must be held invalid. 35 U.S.C. §282(3).

[140] III. CONCLUSION

The Court reaches its conclusion that the patent in suit is invalid reluctantly, not only because of the statutory presumption of validity but also because of the revolutionary nature of the invention disclosed in the specification. Revolutionary patents such as this one are entitled to a liberal construction. *Eibel Process Co. v. Minnesota & Ontario Paper Co.*, 261 U. S. 45, 63 (1923); *Cold Metal Process Co. v. Republic Steel Corp.*, 233 F. 2d 828, 837 (CA 6, 1956). However, even under a liberal construction of the patent in suit, the failure of the claims to focus on or limit themselves to the precise advance in the art by the patentees renders the patent invalid. Certain elements of the claims are simply not adequately supported by the specification to justify the granting of a patent monopoly in the broad language used. Morover, the claims take away from steelmakers the right to operate under certain prior art teachings if they choose.

It is not too much to require that the scope of patent monopolies be precisely defined and confined to the actual invention disclosed by the specification. Article 1, Section 8, of the United States Constitution gives Congress the power to secure to inventors the exclusive right to their actual discoveries, and no more. To grant an inventor a monopoly broader than the scope of his actual invention, even though that invention be revolutionary and fully disclosed in the specification of his patent, is not permitted by the Constitution or patent legislation as interpreted by the courts. *Holstensson v. V-M Corp., supra,* 325 F. 2d 109, 125 (CA 6, 1963).

Again it must be emphasized that it was not inevitable that such an outstanding invention as the oxygen steelmaking [141] process at Linz, Austria, should become the subject matter of an invalid patent in the United States. It is not the responsibility of the courts to remedy deficiencies in patent claims which might have been avoided by a more careful preparation and presentation to the Patent Office. Even liberal construction of patent claims does not extend so far.

In this Court's opinion, the Suess et al. patent in suit, No. 2,800,631, is invalid under 35 U.S.C. § 112 for failure of the claims to particularly point out and distinctly claim the subject matter which the applicants regarded as their invention. A judgment must, therefore, be entered for defendant, without, however, the allowance of attorney fees as requested under 35 U.S.C. § 285, which reads: "The court in exceptional cases may award reasonable attorney fees to the prevailing party." A case is not "exceptional" within the meaning of this provision unless the conduct of the party against whom attorney fees are sought may be characterized as unfair or vexatious, or involves bad faith or some other equitable consideration which makes it unjust that the prevailing party should be left to bear the burden of its own attorney fees. *Plymouth Rubber Co. v. Minnesota Mining & Mfg. Co.*, 203 F. Supp. 595 (D.C. Mass. 1962), aff'd, modified on other grounds, 321 F. 2d 151 (CA 1, 1963), cert. den. 375 U. S. 969 (1964); *Hyster Co. v. Hunt Foods, Inc.*, 263 F. 2d 130 (CA 7, 1959); *Rohr Aircraft Corp. v. Rubber Teck, Inc.*, 266 F. 2d 613 (CA 9, 1959). No such characterization of plaintiffs' conduct is even remotely justified.

Of course this Court has considered all the issues raised by the parties in this litigation including the issues of infringement and misuse, and the Court has reached its conclusions [142] with respect to all issues in the case only after an intensive review of the entire record. A detailed study of the pertinent evidence was necessary, particularly with respect to the issue of infringement, because of the relevance of such a study to the question of validity as well. However, in view of the Court's holding of invalidity, it becomes unnecessary at this time to discuss the issues of infringement and misuse, those issues having become moot. *Bobertz v. General Motors Corp., supra,* 228 F. 2d 94, 101 (CA 6, 1955), cert. den. 352 U. S. 824 (1956). Such discussion would only serve to lengthen unduly this already protracted opinion.

The parties are invited to submit further proposed findings of fact consistent with this opinion. An appropriate order may be submitted.

RALPH M. FREEMAN [SGD.]
United States District Judge

DATED: July 6th, 1966.

Final Judgment of the District Court

[Entered July 19, 1966]

This action having come on to be heard on the pleadings, proofs, briefs, and arguments submitted by the parties and the Court having rendered an opinion which shall stand as findings of fact and conclusions of law.

It is hereby ORDERED, ADJUDGED AND DECREED as follows:

1. Plaintiffs' amended and supplemental complaints are dismissed.

2. Claims 1 and 2 of U. S. letters patent No. 2,800,631 to Suess et al. are invalid for failure of the claims to comply with 35 U.S.C. Sec. 112.

3. Defendant shall recover its costs in this action from plaintiffs, which costs shall be taxed, hereafter, by the Clerk, pursuant to Rule 54(d) of the Federal Rules of Civil Procedure.

4. Defendant's request for the allowance of attorneys' fees under 35 U.S.C. Sec. 285 is denied.

5. Defendant's counterclaim for a declaratory judgment that United States patent No. 2,800,631 is not infringed by defendant and that said letters patent is unenforceable because of misuse has become moot.

6. This judgment is intended as a final judgment.

[SGD.] RALPH M. FREEMAN
United States District Judge

Dated: July 19, 1966

APPENDIX B

United States Patent Office

2,800,631
Patented July 23, 1957

2,800,631

METHOD OF CARRYING OUT MELTING PROCESSES

Theodor Eduard Suess, Luxembourg, and Herbert Trenkler, Hubert Hertzmann, and Rudolf Rinesch, Linz (Danube), Austria; said Suess assignor to Vereinigte Österreichische Eisen- und Stahlwerke Aktiengesellschaft, Linz (Danube), Austria, a corporation of Austria

Application Nov. 16, 1955, Serial No. 547,233

2 Claims. (Cl. 75—60)

This invention relates to a process for the treatment of metallic or metal-containing materials with oxygen-containing gases, preferably high purity oxygen, and has particular relation to a process of this type in which fusible materials are treated at high temperatures with said gases. Still more particularly, the invention relates to a process for the refining of molten metal with high purity oxygen blown downwardly onto the surface of a bath of the molten metal.

The invention is particularly adapted to the refining of primarily hot metal charges, for example, molten pig iron, but it is also applicable to the production of refined metals from solid charges, such as solid pig iron for the production of steel, as hereinafter set forth. The invention is also characterized by the fact that the heat required for the refining of the molten impure metal is autogeneous, being produced primarily by reaction of the oxygen gas with the impurities in the molten metal, although when utilizing solid charges of impure metal, the heat required for melting of the charge prior to refining is provided by combustion of a suitable fuel with the oxygen gas.

Processes for the utilization of high purity oxygen in the refining of molten metal charges, such as pig iron, have been suggested ever since the development of the original pneumatic process by Bessemer. Attempts to blow with high purity oxygen in a conventional Bessemer or Thomas converter through bottom tuyeres has resulted in the destruction of the refractory bottom within the short time of one heat. On the other hand, high purity oxygen refining processes have been previously proposed in which the oxygen is directed onto the molten metal bath surface in the form of a jet or jets issuing from tuyeres positioned in the wall of the refining vessel above the melt line. In such processes, the horizontal velocity component of the oxygen jet at the melt surface causes the development of excessively high temperatures above and at the melt-slag interface on the side of the vessel opposite the tuyeres or oxygen jet inlet so that a rapid deterioration of refractory occurs. In addition, with such an inclined oxygen jet, a loss of oxygen efficiency results due to deflection of the gas from the melt surface and burning of a large proportion (40–50%) of the evolved carbon monoxide to carbon dioxide above the melt, which is further undesirable in contributing to the short refractory life. In addition, the heat produced by high purity oxygen-molten metal reactions is more than sufficient to provide the heat necessary for completion of the refining reactions to the desired steel analysis, and this large amount of additional heat developed within the refining vessel due to carbon monoxide combustion is undesirable. Further, in the utilization of high purity oxygen as the refining medium, the reduction in oxygen efficiency resulting from this combustion of the carbon monoxide with a portion of the oxygen fed cannot be tolerated.

Accordingly, it is recognized that the application of such processes, in which the molten materials, for example pig iron, are treated in refining devices provided

with refractory linings are severely limited due to the extremely high temperatures developed by reaction of the high purity oxygen gas with the molten metal and the short life of the refractory linings when exposed to such temperatures. This is particularly true in those processes, such as production of steel, in which chemical reactions capable of causing corrosion of the refractory lining take place. Thus, in a device provided with refractory lining, such as a converter in the previously proposed processes when high purity oxygen is blown to the surface of a bath of molten pig iron, with or without a slag cover, combustion of the impurities in the metal, and also iron itself result in such extremely high temperatures that the refractory lining is attacked and damaged to such extent that it must be renewed after a short period of use. The refractory materials known at present are unable to resist attacks and stresses of this kind unless the lining is protected by the application of particular conditions from direct exposure to the strong heat developed by the high purity oxygen-molten metal reactions. Accordingly, although the advantages of molten metal refining with high purity oxygen have been recognized, particularly with respect to the reduced nitrogen ballast compared to the air blown pneumatic refining processes, there remains no economical, commercially feasible process for refining of molten metal with high purity oxygen capable of providing long refractory life and high oxygen efficiency. In particular, the deficiencies of the proposed processes, emphasize the lack of a high purity oxygen refining process for molten pig iron having the aforementioned advantages to provide an economical, commercially feasible process for production of refined steel at least equal in quality to that produced by the well known basic open-hearth process from pig iron of widely varying chemical compositions.

It is accordingly one of the main objects of the present invention to provide a process for refining molten metals by surface blowing with high purity oxygen, in which, owing to the particular conditions employed, the refractory walls of the apparatus utilized in carrying out the process are protected from undue corrosion by the excessively high temperatures developed and the chemical reactions taking place at such temperatures.

Another object of the present invention is to carry out the treatment of molten metals, and other molten materials by surface blowing with high purity oxygen in such a manner that the reactions of the oxygen gas with the constituents of the molten bath and the resulting high temperatures, to the extent possible, are limited to an oxygen jet impingement area removed from the refractory lining of the reaction vessel.

It is also a primary purpose and object of this invention to provide a process for the refining of primarily hot metal charges, that is, predominantly molten pig iron, with high purity oxygen gas in which controlled refining at substantially theoretical oxygen efficiency is accomplished.

A further object is to provide a process for refining of molten pig iron with a surface blown high purity oxygen jet in which an exceptionally high refractory life is obtained.

The invention also has as its object to provide a process of surface blowing molten pig iron with high purity oxygen in which the refining reactions and oxygen impingement on the melt surface are controlled in a manner such that over-oxidation of the molten pig iron bath is essentially avoided.

It is still another object of the invention to provide a high purity oxygen refining process which is applicable to pig iron of widely varying chemical compositions, including in particular pig iron of analyses used in or-

dinary basic open-hearth practice, as well as those of higher silicon and phosphorus content required for blowing in the acid Bessemer and basic Thomas converter processes to produce steels having analyses and qualities at least comparable to that of basic open-hearth steels. Another object of the invention is to provide a high purity oxygen refining process for production of steel of excellent quality at a high rate of production, substantially comparable to Bessemer or Thomas converter practice, for example, a blowing time of from 15 to 30 minutes for charges of from 30 to 40 tons to carbon end points of 0.05% or below.

Further objects and advantages of the invention will be apparent from the following detailed description of the process and the appended drawing.

The process of the invention generally comprises refining the molten metal in a converter type or other suitable vessel with a high purity oxygen jet impinging vertically or approximately vertically on the melt surface substantially at the central portion thereof by means of a blast nozzle or other suitable jet producing means under controlled conditions, hereinafter defined, to supply to the molten metal the required amount of oxygen for completion of refining within a predetermined time, and to produce autogenous heat sufficient to insure completion of the refining and adequate temperature in the refined charge for subsequent handling.

It has been found that by suitable arrangement of the nozzle or jet producing device, and operation thereof for the supply and introduction to the molten metal of the high purity oxygen gas, suitable design of the refractory lined refining device in which the process is conducted, and proper use of amounts of materials charged, the foregoing advantages are obtained, including a very efficient protection of the refractory lining.

According to the process of the invention, the high purity oxygen jet is blown vertically, or approximately vertically upon the central portion of the surface of a bath of the molten metal, the jet having a diameter and static pressure at the point of origin, that is, at the blast nozzle or other jet producing means, and the point of origin (blast nozzle) being spaced from the bath surface, such that direct contact of the oxygen jet and the molten metal is established and maintained throughout the refining period without deep penetration of the molten metal bath by the jet. In so operating, the area of jet impingement is controlled to produce a relatively confined zone of direct oxygen to molten metal contact with respect to the total surface area of the bath. It has been determined in application of the present invention to the refining of predominantly molten pig iron charges by means of high purity oxygen, that the jet blown onto the surface of the molten iron, as above described, under a relatively low static pressure at the point of origin, for example, at the overhung blast nozzle, of from 5 to 25 atmospheres (about 75 to 375 pounds per square inch), preferably at about 8 to 12 atmospheres (about 115–175 pounds per square inch), with the jet diameter at the point of origin or blast nozzle being about 1 millimeter (1/25 inch) per ton of charge, and with the point of origin or blast nozzle spaced from the bath surface from at least 150 millimeters (about 6 inches) up to about 2000 millimeters (about 80 inches), produces a sufficiently high reaction velocity of the oxygen with the bath constituents to insure the development of autogeneous heat at a rate sufficient to provide the heat required for completion of the refining in a minimum of time, consistent with controlled temperature and control and development of other necessary and required process conditions, such as fluid slag, avoidance of overoxidation (undue loss of iron to the slag), and avoidance of slopping. The process conducted under these conditions avoids a deep penetration of the oxygen gas into the molten bath which seriously impairs refractory life at the bottom of the refining vessel. In addition, the impingement area of the high purity oxygen on the central portion of the bath isolates the refractory walls of the refining vessel from the extremely high temperatures which are developed by the direct reaction of the oxygen and the molten metal.

It has also been found, according to the invention, that the utilization of suitable design of reaction vessel and the use of the proper amount of material charged results in a ratio of the depth of the bath to the surface area of the bath which augments the protection afforded to the refractory lining of the refining vessel and is also beneficial to the progress of the refining reactions to produce finished steels of low impurity content comparable to those produced by the basic open-hearth process. In carrying out the process of high purity oxygen refining of a molten bath of pig iron, the refining vessel is of such design and the charge is of such amount that the ratio of the depth of the molten bath in meters to the surface area of the molten bath in square meters should be from about 1 to 5 to about 1 to 28 in refining vessels of various design or in terms of the ratio of depth to diameter of a circular bath between 1:2.5 and 1:19. In other metallurgical processes to which the present invention is adapted substantially similar ratios may be used.

Although it is not intended to limit the present invention to any specific theory of action or mechanism, it is believed that application of the oxygen jet substantially vertically or approximately vertically upon the central portion of the bath surface brings about a flow in the molten metal from the center of the surface of the bath downwardly and then along the bottom of the refining vessel, and upwardly at the sides of the vessel to the surface of the bath, so that portions of the unrefined metal are continuously presented to a localized center of direct oxygen reaction with the bath metal, while reacted or oxidized portions of the bath move away from this reaction center. This apparent circulation of the molten material is facilitated by shaping of the bottom of the device in its refractory lining in a uniformly curved design, preferably hemispherical or similar shape, so as to offer the minimum of resistance to the circulation.

Due to the very high affinity of oxygen for iron, initial contact of the high purity oxygen jet with the molten metal bath causes a rapid combination of oxygen and iron to form FeO in the confined central reaction zone. This is demonstrated by ignition of the oxygen and the propagation of a visible flame within the first minute of blowing. This reaction, together with oxidation of impurity elements, such as silicon and manganese, develops extremely high temperatures in the zone of direct oxygen contact with the molten metal which approach the boiling point of iron, as demonstrated by the evolution of a fume containing iron oxide and manganese oxide. A portion of the iron oxide goes to the slag with the other oxidized elements and a portion diffuses into the bath under the influence of the bath circulation, so that within the first three minutes of the blowing vigorous carbon combustion is initiated due to the high temperatures developed by these reactions. The ensuing reaction of carbon with the FeO and directly with the oxygen gas in the confined direct oxidation zone causes rapid formation of carbon monoxide and the formation of this CO causes a strong boil or agitation of the bath, which augments the bath circulation to continuously present unrefined metal to the oxygen gas reaction zone and to create a slag-metal emulsion. The oxygen jet thus contacts the emulsion of bath and slag components which presents a larger reaction surface and causes the refining reactions to progress rapidly although the oxygen jet does not penetrate deeply into the molten metal bath and is confined to an impingement area at the central portion of the bath surface. This vigorous boiling action is opposed by the pressure of the oxygen jet only in the area of impingement, and outside of this area it represents primarily endothermic

Suess et al. Patent 2,800,631.

reduction of FeO by carbon to form the evolved carbon monoxide, which reaction thus effectively encompasses the zone of direct oxygen reaction at which the highest temperatures prevail affording a maximum measure of protection to the refractory lining of the refining vessel.

In conducting the process in the manner set forth above, the advantage of exceptionally high refractory life is obtained. For example, in refining of pig iron having the following chemical composition: carbon 3.8–4.2, silicon 0.6–1.3, manganese 1.4–2.2, phosphorus 0.120–0.250, and sulfur 0.045 max., and a slag having the following composition SiO_2 12–17%, CaO 38–44%, MgO 3–10%, MnO 9–13%, P_2O_5 1.2–1.8%, and Fe 12–17%, in a 30 ton converter, the average durability of the refractory is over 200 heats (foregoing in percentages by weight). By comparison, in basic Bessemer practice utilizing air rather than high purity oxygen, the removable converter bottom must be relined after only 35 to 60 heats. In addition, the refractory life obtainable by the process of the invention surpasses that obtained in normally operated open-hearth practice in that in refining of a normal charge by basic open-hearth about 36 lbs. of refractory brick is consumed per ton of steel produced to which must be added some 40 pounds of sintered dolomite for fettling operations, whereas total refractory consumption in the instant process is only about 24 lbs. per ton of steel produced. This advantage is even greater when compared to oxygen lancing in an open-hearth which accelerates refractory consumption.

The further advantage of high oxygen efficiency is obtainable according to the process of the invention when the oxygen jet impinges on the central portion of the molten bath surface from directly above, that is, approximately vertically. Oxygen efficiencies calculated on the basis of total oxygen input compared to oxygen consumed in the bath reactions is approximately 95%. This is demonstrated by an average oxygen consumption of only 57 normal cubic meters (measured at standard conditions of temperature and pressure) per ton of steel including oxygen consumption for heating the converters after relining. This compared with calculated or theoretical oxygen requirements for the refining of the various pig irons blown to steel analyses set forth below represents about a 95% efficient utilization of oxygen. In addition, analyses of waste gases effluent from the converter indicate that the carbon in the instant process burns almost 100% to carbon monoxide, the analyses showing on the average over 90% CO and less than 10% CO_2, indicating that the oxygen input is not lost by burning with the carbon monoxide above the melt within the refining vessel, as in the case of low angle impingement from tuyeres positioned in the side walls of the refining vessel. Moreover, this is a distinct advantage in the instant process, since the reaction of the oxygen with the melt provides more than sufficient heat for the refining, and additional heat by burning of the carbon monoxide to carbon dioxide above the melt is to be avoided. The potential heat units in the effluent carbon monoxide may be utilized in various ways by subsequent burning.

As above mentioned, it is a characteristic of the process of the invention that in the confined zone of direct oxygen reaction at the surface of the molten metal bath, the oxidation products of the impurities in the pig iron, such as silicon and manganese, as well as the oxidized iron form an early fluid slag which is always very rich in oxides, that is, highly oxidizing. With the formation of the slag-metal emulsion, the iron oxide reacts with the carbon present in the bath, primarily outside of the direct oxygen-metal reaction zone, and since such slag-metal reactions are endothermic, the molten bath is maintained cooler in the vicinity of the walls of the refining vessel or converter. For example in the formation of one kg. of FeO, by direct oxidation with the oxygen jet and absorbed as iron silicate into the slag, 80 kg. calories of heat are developed. An equal amount of heat is absorbed outside

of the confined central zone of direct oxidation as the FeO (as silicate) is reduced by the carbon in the bath, as one example of slag metal reactions occurring during the blowing.

This formation of an early highly oxidizing fluid slag is of particular value in basic refining when the process is applied to pig iron of analyses used in ordinary open-hearth practice, which would not be amenable to refining by either the acid Bessemer process due to the phosphorus content, or the basic Thomas process due to the lack of sufficient phosphorus. With the rapid heating of the slag cover and metal bath, the proper amounts of lime or lime supplying substance, such as limestone, may be added at the beginning of the blow and during the blow to insure formation and maintenance of a slag of sufficient basicity. Thus, the early fluid, basic and highly oxidizing slag formed provides an accelerated rate of phosphorus and sulfur removal from the bath, leaving the finished steel very low in both elements. With normal open-hearth pig irons having phosphorus contents ranging from about 0.1–0.35%, and even higher, e. g., 0.85% P, and with correct lime additions, final phosphorus contents not higher than about 0.025% and as low as 0.010% are obtained by the time the carbon end point is reached with only a single slagging operation. With sulfur contents in the pig iron of from 0.045 to 0.08%, the sulfur is decreased to 0.02–0.025%, and on the lower range of sulfur in the pig iron to values as low as 0.012%. In usual operations, from 1 to about 4.5% lime is charged to obtain the foregoing result, depending upon the phosphorus content in the pig iron. In addition, all of the lime requirement may be added during initial charging before blowing is started, particularly where the silicon content of the pig iron, which is one of the first oxidized elements, is sufficiently high. On the other hand, the lime may be charged in increments during the blow, but with a sufficient amount initially charged to provide a basicity adequate to absorb the phosphorus.

In the normal range of phosphorus in pig iron of basic open-hearth quality from about 0.1 to 0.35%, the required slag volume including the lime charge is advantageously much lower than the slag volume in the bottom blown basic Thomas process. The iron content of the slag varies from about 9 to 18%, with generally higher FeO content in the slag at higher phosphorus contents in the pig iron, and also at lower manganese contents. Accordingly, the lower percentage of slag, for example, 11 to 12% compared to about 22% in the Thomas process results in comparable or lower total iron content lost to the slag, even though the FeO content of the slag may be higher than the usual 10% in the basic Thomas process.

The process in its preferred embodiment utilizes high purity oxygen, by which the term is meant oxygen gas analyzing at least 97% O_2. For minimum nitrogen content in the finished steel of at least 98% oxygen and preferably 99% or higher should be utilized. The frequency curves based on produced steel analyses indicate that oxygen of at least 98% purity provides a peak or maximum at a nitrogen content of from 0.002 to 0.003%, with 95% of all heats blown showing a nitrogen content of 0.004% or less.

The vigorous boil, above mentioned, continues up to the carbon end point, and together with the induced circulation of the bath metal toward and away from the central zone of direct oxygen reaction, effectively counteracts any tendency to overoxidation of the bath. When the flame dies and carbon combustion is completed, the bath becomes relatively quiet and intimate contact between slag and metal bath ceases. The turbulence of the bath and slag due to the oxygen stream impinging from directly above is insufficient to cause continuance of oxygen-metal reactions. As a result, steels blown by the process of the invention do not suffer from the deteriorating effects of high oxygen (FeO) contents. Direct oxygen determination by the hot extraction method yielded oxygen con-

tents of 0.04% maximum for heats that were blown to a carbon end point of from 0.03 to 0.10% C. Thus, the oxygen content of steels produced by the high purity oxygen blowing process compare very favorably with oxygen contents of basic open-hearth steel in the same carbon range, and are definitely lower in oxygen content than bottom blown Bessemer steels using air, oxygen enriched air, oxygen and steam, or other gas mixture.

As in the basic Bessemer process, the silicon is rapidly eliminated. However, in contrast to the basic Bessemer process, the use of high silicon charges presents no problem due to the fact that slopping is not encountered in the process of the invention to any degree similar to that in the bottom blown Bessemer practice. In fact, higher silicon pig irons actually are advantageous in the high purity oxygen blowing due to the heat producing effect of this element in the early stages of the blow with the result that higher scrap charges can be made in the process.

Regarding scrap additions, the process advantageously may utilize scrap charges of up to about 30%, depending primarily upon the silicon content of the pig iron, and also on the temperature of the hot metal charge. For lower ranges of silicon, such as 0.3 to 0.7% scrap charges of from 10 to 15% are permissible. With silicon in amounts from 1 to 1.2%, scrap charges of 20 to 25% may be utilized.

In general, the manganese content of the fully blown metal and of the slag increases with the total manganese content (pig iron and scrap). However, it is a characteristic of the oxygen steel making process that the high temperatures developed in the reaction zone between the bath metal and the slag cause a rereduction of manganese from the slag into the bath during the latter portion of the refining period. In the last minutes of the blow, the manganese content in the bath again decreases as the carbon drops to its final value, that is, at a normal end point of 0.04–0.06. Accordingly, the manganese content in the finished steel and in the slag is subject to some control, and is governed by slag composition and volume, temperature and final carbon content. With the use of a minimum amount of slag rich in iron oxide, for example only 70 kg. per ton of steel, the amount of loss of manganese to the slag by burning may be considerably reduced. As above mentioned, extensive tests have shown that the amount of slag can be kept considerably lower than the conventional pneumatic process, such as the Bessemer and Thomas processes. Under these conditions of high developed temperature in the refining process and low slag volume with high iron oxide content, a finished steel containing manganese in quantities at least 10 times the amount of carbon, for example, 0.6 to 0.8 Mn at carbon end points of 0.03% are obtainable. Accordingly, it is possible to pour rimming steels down to relatively very low carbon contents without any addition of manganese and deoxidizing agents. Under actual operating conditions the best practice for production of standard grades is to refine down to 0.06–0.08% C and to recarburize in the ladle. This practice results in a manganese content of from 0.6 to 0.8 and eliminates the necessity for manganese additions to conform with the usual analysis specifications. The above manganese content easily compares with the conventional composition of rimming low-carbon open-hearth steels, in fact such analyses are near the upper limit of the range. It is also possible to catch the heat at higher carbon contents, so that the resulting content in manganese will be of a higher order than is normally encountered in rimming open-hearth steels of identical carbon content. Thus, it is possible to produce rimming low carbon high purity oxygen blown steels of a predetermined strength which is based on an inherently higher manganese content of the heat.

It has also been found that a steel containing 0.1% carbon and as high as 1.5% manganese may be obtained, for example by the addition of ordinary blast furnace

ferromanganese, e. g., 15 kg. of 48% blast furnace ferromanganese per ton suffices, and results in an increase of about 0.05% in the carbon content. In normal steel making operations it was not previously possible to obtain such steels without the use of expensive refined ferromanganese products. Steels of such analyses, not only exhibit increased toughness and yield strength but other properties, such as pressure weldability, are improved.

To exemplify the high manganese recovery in the steel without ferromanganese additions after the blow, the results of the following heats are provided. As indicated above, since the manganese content, under otherwise equal conditions, increases in the finished steel with increase in pig iron, it is to be noted that particularly high manganese content pig irons were employed. Nevertheless, it is evident that due to the extremely high temperatures developed in this high purity oxygen process, a manganese recovery is possible which cannot be reproduced in known processes.

Heat No. 1.—Pig iron analysis: 4.16% C, 3.02% Mn, 0.14% Si, 0.074% P, 0.040% S. Last converter control test (without ferromanganese or deoxidizers): 0.09% C, 0.96% Mn, 0.005% Si, 0.039% P, 0.013% S, 0.007% Na.

Heat No. 2.—Composition of pig iron: 4.30% C, 3.24% Mn, 0.33% Si, 0.072% P, 0.034% S. Last converter control test (without ferromanganese or deoxidizer): 0.08% C, 1.02% Mn, 0.005% Si, 0.037% P, 0.010% S, 0.004% Na.

Heat No. 3.—Composition of pig iron: 4.21% C, 2.88% Mn, 0.27% Si, 0.076% P, 0.044% S. Last converter control test (without ferromanganese or deoxidizer): 0.07% C, 0.93% Mn, 0.005% Si, 0.037% P, 0.012% S, 0.004% Na.

From the foregoing test, it may be seen that manganese recovery at least 10 times as high as the final carbon content in the finished steel is obtainable by the process of the invention utilizing pig iron having manganese on the order of 3%.

In regard to output, the combustion of the impurities of the pig iron and the iron content of the slag total a loss of about 8.0% with an additional 0.8% of iron lost in the dust fume from the process. With mechanical losses averaging about 0.8%, the percentage recovery of the refining process is approximately 90%, comparable to the yield obtainable by the basic open-hearth process. In the progress of the high purity oxygen blowing, up to about the eighth minute, oxidation of the iron progresses under formation of comparatively large amounts of FeO, which, as above stated, promotes a desirable quick liquefaction of the basic lime slag. At this stage in the blow, the slag shows maximum values of from 25–30% FeO. In the further course of the process reduction of Fe from the slag occurs which continues until the carbon content of the bath of about 0.07% is reached. The FeO in the slag decreases to about 10–12%. On further removal of carbon, the FeO in the slag again increases so that in the final slag generally an iron content averaging 14% is obtained, and only at very low carbon heats does the iron content exceed this value.

Under these known metallurgical conditions above set forth, the total oxygen requirement is calculated on the basis of oxygen pick-up of the heat during the refining period. Summation of these oxygen gas volumes required for the oxidation to complete refining indicates substantially a straight line function on oxygen input, and corresponding to this relative constancy of oxygen input, the oxygen pick-up proceeds uniformly during the blow. The oxygen input is maintained at a rate such that the speed of the refining process insures satisfactory rereduction of FeO from the slag, in the manner set forth above. In actual practice, based on experience in operation of 30 ton converters, oxygen feed rates may be maintained such that depending upon pig iron analysis, amount of scrap addition and desired finished steel analysis, the

refining to usual carbon end points on the order of 0.05% C is completed in from about 15 to about 30 minutes, preferably 18 to 22 minutes. Flow rates of from about 4000 to 8000 cubic meters of oxygen per hour are representative of the oxygen input under these conditions.

In such exemplary commercial practice with 30 ton converters charged to 35 to 36 tons, oxygen pressures at the blast nozzle of about 8 to 10 atmospheres and oxygen jet or blast nozzle diameters of from about 27.5 to 35 millimeters (1.1 to 1.4 inches) with nozzle spacings varying from 25 to 50 inches (about 650 to 1250 millimeters have been used, the preferred spacing being from 30 to 40 inches (about 750 to 1000 millimeters). In general, it may be stated that as the oxygen pressure and nozzle diameter are increased, the nozzle spacing is also increased, for example, as the capacity of the refining vessel and total charge is increased. Under these conditions, deep penetration of the molten metal bath is avoided, while the necessary displacement of the slag cover to maintain direct oxygen to molten metal contact is insured. However, in the unusual circumstances of an abnormally stiff slag cover, the blow may be initiated using mechanical means for penetrating the slag cover to establish oxygen to metal contact.

It is to be noted, that in certain instances particularly where the rate of oxygen input is relatively high, that is, the total blowing time is in the lower portion of the range above stated, the pressure of the oxygen jet at the blast nozzle may be reduced in the last few minutes of the blow to reduce the rate of oxygen input, which is beneficial in supporting the inherent characteristic of the process in regard to avoidance of over-oxidation of the heat. Due to this characteristic of the process, it is generally unnecessary to utilize any deoxidizing agents such as ferromanganese and ferrosilicon in the production of semi-killed steels, and only in the production of killed steels are the conventional deoxidizers employed.

The process has as one of its major advantages the applicability to pig iron of analyses used in ordinary open-hearth practice, which would not be amenable to refining by either the acid Bessemer process or the basic Thomas process. In addition, the process is fully applicable to pig irons having analyses of the type which are normally utilized in either the acid Bessemer or basic Thomas processes. Typical illustrations of the following pig irons and the finished steels produced therefrom indicate that the process produces steels comparable to open-hearth quality from pig irons of widely varying phosphorus and silicon contents.

(1) 4.0% C, 1.5–2.0% Mn, 0.7–1.2% Si, 0.1–0.24% P, 0.05% S, and 0.01% N blown to a finished steel of the following analysis: 0.06% C, 0.35% Mn, 0.00% Si, 0.026% P, 0.025% S, and 0.0025–0.0035% N (oxygen about 98%).

(2) Pig iron analyzing 3.6–4.25% C, 1.4–3.2% Mn, up to 0.3% Si, 0.06–0.1% P, 0.04–0.07% S, and 0.01% N from which steel of the following analysis is obtained: 0.06% C, 0.35% Mn, 0.00% Si, 0.01–0.02% P, 0.022% S, and 0.001–0.002% N.

(3) Illustrative of a grade of pig iron falling between that of normal open-hearth analysis and basic Bessemer pig iron is the following: 3.61% C, 2.16% Mn, 0.46% Si, 0.856% P, 0.062% S. Blowing of such a charge of rather unfavorable chemistry by the process of the invention yielded a steel of the following composition: 0.04% C, 0.15% Mn, 0.0% Si, 0.014% P, 0.045% S Clearly, such a pig iron would be definitely unsuitable for basic Bessemer (Thomas) process refining, and would also present considerable difficulty if used for open-hearth refining.

The accompanying drawing diagrammatically illustrates a device for carrying out the present invention. In this drawing, reference numeral 1 denotes a metallic wall and 2 the refractory lining of the refining vessel. An oxygen supply lance 3 is centrally positioned and overhung above the charge and is provided with a nozzle

3' for the introduction of the oxygen gas, inserted in an opening of the cover 4. The material charge, including molten pig iron, molten scrap, and slag forming additions, such as limestone, is indicated at S and the depth and diameter of the upper surface of the molten mass in the quiescent state are denoted by H and D, respectively. The lance 3 is retractable, and is provided with water cooling ducts and connections (not shown). The cooling water in actual practice is supplied to the lance at a pressure of from 4 to 6 atmospheres and the normal flow rate is about 36 to 40 cubic meters per hour. Under such conditions the temperature of the cooling water increases from approximately 14° centigrade input to a maximum of about 50° centigrade in the effluent from the lance.

In the preferred commercial practice of the invention, a converter shaped vessel with an open mouth is usually provided, through which the lance is inserted into and retracted from operating position, as indicated in the example set forth below. In this manner, suitable gas take off devices may be positioned at the throat of the converter type vessel to collect the off gases and separate the particulate fume therefrom.

The following is a detailed description of a typical operation of the process, which is not to be regarded as a limitation on the invention, but rather as a complete specific embodiment thereof.

Example I

A closed bottom converter of normally 30 tons (metric) capacity is charged with a total of about 36 tons of metal through an open mouth. The oxygen lance is inserted through the mouth of the converter to the adjusted distance above the melt surface. The diameter of the surface of the bath with such a charge is about 3 meters and the depth of the bath about 1 meter. A typical cycle of operations is given below on a time table basis.

	Hours
7100 kg. plant return scrap charged to converter	0
29,600 kg. pig iron poured from mixer into converter having an analysis as follows: 4.04% C, 0.99% Si, 1.73% Mn, 0.153% P, and 0.043% S	0.08
Addition of 850 kg. limestone and 60 kg. bauxite	0.10–0.13
Introduction of nozzle, oxygen jet initiated at a nozzle pressure of 10 atmospheres (147 P. s. i.) with a nozzle spacing above the bath of 1000 millimeters	0.15
850 kg. limestone and 200 kg. rolling mill iron slag added	0.16
750 kg. limestone chips added in five parts of 150 kg. each	0.22–0.28
Oxygen pressure reduced to 8 atmospheres	0.30
Mouth flame transparent, nozzle withdrawn, oxygen supply turned off—end of blowing time at 19 minutes	0.34
Converter contents sampled and analyzed as follows: 0.05% C, 0.00% Si, 0.31% Mn, 0.024% P, 0.02% S	0.35
Slag drawn off	0.35–0.39
150 kg. Spiegel iron added to contents of converter	0.39
Slag remaining in converter stiffened with 30 shovelfuls of limestone	0.39–0.42
Steel poured into pan, temperature measured at 1575° C., 6 kg. electrofluor added to pan	0.42–0.45

Final test analysis on pouring into ingot mold was: 0.07% C, 0.32% Mn, 0.022% P, 0.020% S, 0.0035% N. Oxygen consumption 1950 cubic meters. This oxygen consumption is about 54 cubic meters (measured at standard conditions) per ton and compares with a theoretical oxygen requirement of 51 cubic meters (measured at standard conditions), and therefore indicates an oxygen efficiency of 95%.

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The process of the present invention may be also applied to the production of metals, for example, production of steel, from solid starting materials. In the production of steel, pig iron and scrap iron, and if desired certain alloys and fuels, such as coal or wood, are introduced into the refining vessel. As materials for producing heat for melting, coke, ferrosilicon, calcium carbide, aluminum alloys and the like, which are converted into slag or gaseous products at the prevailing refining temperatures can be added. The total amount of the starting material mixture may be introduced as a single charge prior to initiation of the melting, or may be gradually fed in small incremental amounts. Sufficient fuel should be present for producing the combustion necessary to provide the heat of fusion of the solid charge. After ignition of the fuel, melting of the initial mixture is brought about by the action of the oxygen jet.

The melting procedure is started by means of an ignited body which is introduced immediately prior to the initiation of blowing of the oxygen jet, and is preferably positioned at that portion of the solid charge where the oxygen jet comes in direct contact therewith.

Thus, according to the present invention, a steel may be produced with a minimum consumption of fuel, for foundries or rolling mills, by melting the iron to be converted into steel with low grade fuel and a high purity oxygen jet blast, for example, in cupola furnace, or in a converter type vessel itself, and subjecting the thus melted solid charge to high purity oxygen refining in the above described manner in a suitable refining vessel, such as a converter. In carrying out such a melting and refining treatment with high purity oxygen, the energy consumption is extremely low, amounting to only 100 cubic meters of oxygen (measured at standard conditions) per ton of steel produced. Of course, as indicated above in the refining of primarily hot metal charges constituting pig iron with analyses as set forth above to refine steels of 0.05% carbon content and analyzing as above indicated, the average oxygen consumption is only about 57 cubic meters per ton (measured at standard conditions).

The present process of surface blowing with high purity oxygen is also applicable to the desulfurization of copreous materials and to the production of glass in the converter with the use of sodium chloride. Furthermore, the process is applicable to the treatment of blast furnace slag to the elimination of sulfur and conversion of slags into melted cement or glass-like materials of the type used for the manufacture of slag wool.

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This application is a continuation-in-part of my copending application Serial No. 206,147, filed January 16, 1951, now abandoned. It will be understood that the present invention is not limited to the specific materials, steps and other specific details described above and may be carried out with various modifications without departing from the scope of the invention as defined in the appended claims.

We claim:

1. Method of refining molten impure iron in the presence of a slag in a vessel having a refractory lining by blowing with oxygen, which comprises discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath at the central portion thereof, to an extent to avoid material agitation of the bath by the oxygen stream, the contact of the oxygen with the bath resulting in reaction of the oxygen with a portion of the iron and with the oxidizable impurities of the bath in a localized reaction zone spaced a substantial distance from the refractory lining, the reactions in said zone resulting in refining of the iron and gas evolution and in the production of high temperature in the reaction zone away from the refractory lining, said reaction producing a circulatory movement in the molten metal, which circulatory movement brings those portions of the molten metal bath which are remote from the reaction zone into the reaction zone whereby those portions are subjected to said reaction with minimum injury to the refractory lining.

2. The gaseous oxygen process set forth in claim 1 in which the oxygen is blown into said vessel under pressure in a range between about five and about twenty-five atmospheres above normal atmospheric pressure.

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FOREIGN PATENTS

623,881	Great Britain	May 24, 1949
642,084	Great Britain	Aug. 30, 1950
983,098	France	Apr. 5, 1948

Claim 1 of Suess et al. Patent No. 2,800,631

Method of refining molten impure iron in the presence of a slag in a vessel having a refractory lining by blowing with oxygen, which comprises discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath at the central portion thereof, to an extent to avoid material agitation of the bath by the oxygen stream, the contact of the oxygen with the bath resulting in reaction of the oxygen with a portion of the iron and with the oxidizable impurities of the bath in a localized reaction zone spaced a substantial distance from the refractory lining, the reactions in said zone resulting in refining of the iron and gas evolution and in the production of high temperature in the reaction zone away from the refractory lining, said reaction producing a circulatory movement in the molten metal, which circulatory movement brings those portions of the molten metal bath which are remote from the reaction zone into the reaction zone whereby those portions are subjected to said reaction with minimum injury to the refractory lining.

PX-2A, pp. 72-77.

Remarks in Amendment of June 11, 1957 in Suess et al. Application Serial No. 547,233

[PX-2A, pp. 72-77]

IN THE UNITED STATES PATENT OFFICE

Applicant : Theodore E. Suess
Serial No. : 547,233
Filed : November 16, 1955 Div. 3
For : METHOD OF CARRYING OUT MELTING PROCESSES

Hon. Commissioner of Patents
Washington , D. C.

* * * * * * *

REMARKS

A letter is directed to the Chief Draftsman requesting the addition of the names of Messrs. Trenkler, Hauttmann and Rinesch to the drawing.

The applicants make claim to the right of priority under the provisions of 35 USC Section 119 to the filing dates of the following Austrian applications:

Application No. A 480/50, filed January 31, 1950
Application No. A 588/50, filed February 6, 1950
Application No. A 1051/50, filed March 1, 1950
Application No. A 1318/50, filed March 13, 1950

Certified copies of the Austrian applications were furnished during the prosecution of the Suess application Serial No. 206,147 in support of a claim of priority therein.

PX-2A, pp. 72-77.

The claims of the application are cancelled and new claims 17 and 18 are substituted therefor in view of the discussion with the Examiner on May 1, 1957.

The new claims are presented in view of information recently made available and which indicates that the instant application discloses a fundamentally different approach to the refining of pig iron or crude iron by means of substantially pure oxygen than was suggested heretofore. The new claims are believed to be properly definitive of the invention.

The applicants, as early as June, 1949, were familiar with methods of refining crude iron or pig iron proposed by the patentees of the Miles et al. French patent No. 933,098 and the Schwartz German Patent No. 735,196. The applicants assumed that the Schwartz and Miles et al. methods were suitable for the production of steel of commercial quality and the applicants attempted to use these methods in their early work. They injected substantially pure oxygen into the molten metal at supersonic velocity from a nozzle closely spaced with respect to the surface of the molten metal so that the jet of oxygen penetrated deeply into the bath of molten metal and agitated the bath violently. The early work with these operating conditions was a complete failure because the quality of the steel (if it could be called steel), was very poor and the reaction resulted in rapid destruction of the refractory lining of the converter in which the blowing operations were conducted. The reaction of the gaseous oxygen with constituents of the bath produces intense heat and the impingement of the intensely heated components or products of that reaction upon the refractory surfaces confining the bath

tends to produce rapid deterioration of the refractory surfaces.

The applicants determined that it was possible to convert the bath of pig iron into steel of commercial quality by blowing the bath with high purity oxygen if the reaction is limited to a part of the bath which is remote from the refractory walls. When the reaction is carried out only in the central part of the upper surface of the molten metal and the central part of the body of the bath of molten metal, out of contact with the refractory surfaces, the circulation induced by the centrally disposed reaction zone subjects the entire contents of the bath to the oxidizing reaction resulting in a uniformly treated product without impinging the high temperature reaction products upon the refractory walls. In other words, by carrying out the reaction in the cental region of the bath remote from the side and bottom surfaces of the refractory lining or walls, the reaction occurring in said central region brings the entire contents of the bath progressively into the reaction zone for reaction with oxygen without producing the destructive effect upon the walls of the container and without the production of an excessively high oxide content in the refined metal. In this way, the applicants were able to turn failure into success by a change in operating conditions which was relatively simple, when once recognized.

An affidavit by Rudolph Rinesch is submitted herewith, the affidavit being supported by an exhibit which shows the early work done by the applicants with the processes taught by Schwartz and Miles et al. and with the new process developed by the applicants. To facilitate the Examiner's understanding of the exhibit an-

PX-2A, pp. 72-77.

nexed to the affidavit, we are enclosing English translations of the terms appearing on the exhibit and the marginal notes at the right-hand end of the exhibit.

It should be noted that test No. Br13 is obviously erroneous in specifying a phosphorous content of 0.96% and was not relied on in the affidavit. Explanation of the obviously high P value was requested of the applicants and in reply a cablegram was received which stated:

> "Br13 only transcribing mistake Stop Fertig analyse should read correctly 0.0096 Stop Similar mistake was made in pig iron analysis in Br26 Stop Fact that in both cases third decimal missing while all other figures in same column contain three decimals proves that only transcribing mistake is involved Stop"

A corroborating affidavit by Hubert Hauttmann is enclosed also.

It is submitted that new claims 17 and 18 properly define the invention and are of a scope commensurate with the invention. Claim 17, the only independent claim, brings out quite clearly the fact that the stream of oxygen is discharged vertically downwardly against the surface of the bath without material agitation of the bath by the oxygen stream and that contact of the oxygen with the bath results in a reaction in a localized reaction zone spaced a substantial distance from the refractory lining of the vessel containing the molten iron. Further, the claim asserts that these new conditions result in the refining of the iron and gas evolution and in the production of high temperature in the reaction zone *away*

from the refractory lining. The reaction in the reaction zone produces a circulatory movement in the molten metal which brings those portions of the molten metal bath remote from the reaction zone into the reaction zone to refine those portions with minimum injury to the refractory lining.

It will be appreciated that the conditions of the reaction and for practicing the method are very different, indeed, from anything shown in the prior art and particularly the process disclosed in the Miles et al. French patent.

Accordingly, it is respectfully urged that the application is now in condition for allowance with claims 17 and 18, the only claims remaining therein.

Respectfully submitted,

BRUMBAUGH, FREE, GRAVES & DONOHUE
Attorneys for Applicants

PX-2A, pp. 78-84.

Rinesch Affidavit Filed June 11, 1957

[PX-2A, pp. 78-84]

IN THE UNITED STATES PATENT OFFICE

Applicant: Theodore E. Suess et al
Serial No.: 547,233
Filed: November 16, 1955 **Div. 3**
For: METHOD OF CARRYING OUT MELTING PROCESSES

AFFIDAVIT

I, Rudolf Rinesch, herewith declare and affirm that I studied metallurgy at the Montanistische Hochschule Mining College in Leoben and was graduated in automn 1938; that I have had twenty (20) years of practical experience in the manufacture of steel, based on practical and managing activity in various steel manufacturing enterprises; that from July 1, 1938 on I worked in the plants of VEREINIGTE OSTERREICHISCHE EISEN—UND STAHLWERKE as development engineer and later on as technical leader of the steel plant; and that I made a dissertation to obtain the doctor grade at the Montanistische Hochschule Mining College in Leoben concerning "The Evolution of the Oxygen Blowing Process"; and that I, Theodor S. Suess (deceased), Hubert Hauttmann and Herbert Trenkler are the joint inventors of the method described in United States application Serial No. 547,233.

I and Messrs. Suess, Hauttmann and Trenkler started our experimental work on manufacturing steel from crude iron by blowing pure oxygen on the surface of melted crude iron in June, 1949. At that time, we were aware of the state of technology as reflected in

the methods now described in German patent No. 735,196 to Schwarz and French patent No. 933,098 to Miles et al.

The two above-mentioned patents disclose blowing oxygen into a bath of melted crude iron from above and providing the oxygen jet with sufficient energy to cause it to penetrate deeply into the bath. The patentees intended to cause the reaction of the oxygen with the crude iron to take place within the bath. Information is not given in the patents about the composition of the crude iron or the analysis of the converted steel, or durability of the refractory lining of the converter and such information was not available to me and Messrs. Suess, Hauttmann and Trenkler at the beginning of our work.

Starting on the basis of the information available in 1949, we tried to manufacture steel from crude iron by blowing oxygen into the bath at a velocity sufficiently high to cause it to penetrate deeply below the surface of the melt. After a few preliminary experiments, we started on June 17, 1949 with a two-ton converter which was charged with crude iron containing 3.8 to 4.0 % C, 1.2 to 1.4 % Si, 1.6 to 1.8 % Mn, 0.12 to 0.17 % P, and approximately 0.03 % S. The bath depth was 500 mm. Bottled oxygen was used as an oxygen source. In order to achieve deep penetration of the bath with the oxygen stream, we employed a Laval nozzle of 8 mm diameter which was arranged approximately 10 cm above the surface of the bath. Oxygen was supplied to the nozzle at a pressure of 8 atmospheres gauge. A Laval nozzle was used for the reason that such a nozzle can discharge oxygen at supersonic speed and the jet of oxygen penetrated deeply into the melt.

PX-2A, pp. 78-84.

An analysis of the crude iron and the slag was made prior to blowing and during the blowing, the temperature was measured several times, the oxygen consumption was measured and finally, analyses were made of the final steel in the converter and after pouring into the ingot mold. All these values are reflected in the attached table identified as Exhibit "A". The experiments made with the Laval nozzle are identified by the annotation "Laval" in column 43 of Exhibit "A".

To our surprise, the tests made with a deeply penetrating oxygen jet did not give satisfactory results. The steel produced with the deeply penetrating blast contained between about 0.10 and 0.13 % phosphorous. Moreover, the lining of the converter was eroded quickly so that considerable quantities of MgO were released from the lining. MgO, as is generally known, causes a slag to react slowly and the slag was unable to absorb FeO which, in its turn, is needed for good dephorphorization. Indeed, a disproportionately higher proportion of FeO is dissolved in the bath so that the iron which is obtained is brittle and cannot be used for rolling and drawing.

The experiments employing a deeply penetrating oxygen stream made us realize that deep penetration of the bath by the oxygen jet must be avoided, if we were to obtain a high quality iron or steel and at the same time, have a satisfactory operating life for the lining of the converter. For that reason, our subsequent experiments were conducted with a normal or cylindrical nozzle through which the oxygen stream was discharged at approximately 280 m/sec. The spacing of the nozzle from the bath was adjusted so that the force of oxygen

blast on the melt surface was controlled and the jet did not penetrate appreciably into the molten bath. As indicated in Exhibit "A", we changed over to a normal nozzle on June 22, 1949. However, we still used the converter which had been eroded by the preceding experiments so that the slag used at that time had too high a MgO content. The converter was relined and other experiments were started on June 25, 1949. Using crude iron of the same composition as that described above, steel was obtained having an analysis within the limits sought by us: carbon below 0.1 %, and phosphorous below 0.05 %, mostly between 0.01 and 0.03 %. An occasional experimental run did not give the expected results, but the majority of the experiments thereafter were successful because we had now determined that a satisfactory refining operation could be obtained so long as the oxygen jet does not penetrate deeply into the bath.

The composition of the slag resulting from the successful experiments shows that the MgO content was below 10 % and that the iron content of the slag increased to an average of 14 to 20 %. Such a slag forms with limestone a very fluid, lime-ferrite slag which absorbs the phosphorous as shown by the fact that it contains an average of 1.2 to 1.8 % P_2O_5, as compared with 0.18 % to 0.3 % P_2O_5 in the slag which was formed by the deeply penetrating oxygen stream.

The success of our experiments grew out of a departure from the methods disclosed in the Schwarz and Miles et al. patents, which were developed for Brassert & Company while the patentees were employed by that company. I know that attempts were made to manufac-

ture steel in accordance with the patented methods in Italy and that such attempts were not successful.

On the basis of our successful experiments, an attempt was made to determine the reason for the differences in the results obtained by our method over the results obtained with the patented methods. As an essential characteristic of our method, I consider the fact that, by our method, a limited center of reaction is created in the surface layer of the bath by blowing oxygen onto the surface through a nozzle which is placed at a considerable vertical distance from said surface. If these conditions are observed, the basic requirements for the course of the reaction as conceived by us are present. In the aforementioned center of reaction, oxygen reacts with iron and with the elements accompanying the iron, such as silicon, manganese and carbon. Thereby, a slag is created which is rich in oxides and heat is set free. This center of reaction is hotter than the rest of the bath and the reaction velocity is very high therein. The iron which in the field of reaction was freed from the elements accompanying it has a higher density than the crude iron and sinks to the bottom of the converter. This movement is aided by evolution of gas so that the molten iron begins to circulate in the converter. The fluid and light slag, together with CO formed during the reaction, cannot rise from the bath against the impact of the oxygen stream, and are diverted away from the field of reaction and towards the outer edge of the bath. The iron oxide in the slag reacts with the carbon which is still present in the melt and consumes heat so that those parts of the bath which are outside the field of reaction are cooled off and the

erosion of the converter lining is correspondingly reduced. The circulatory movement of the molten bath causes automatic self-deoxidation of the bath due to movement of the oxiderich portion of the bath into contact with the un-oxidized portions of the bath, until the desired purification has been obtained.

The above explanation indicates that a steel of satisfactory purity cannot be obtained with a method utilizing a deeply penetrating oxygen stream. Such a deeply penetrating stream creates an uncontrollable turbulence in the bath. The oxygen remains dissolved in the bath and the high oxygen content in the final steel leads to hot shortness or requires unsatisfactory quantities of deoxidizers. Furthermore, the phosphorous cannot be slagged off. Moreover, the walls, and particularly the bottom of the vessel become as hot as the reaction center and, therefore, are eroded severely.

The success of our method is shown by the fact that since 1949 almost two million tons of steel has been produced in accordance with our method at the plant of affiant's assignee and recently, the plants using our method have been expanded to give a yearly output of one million tons. Throughout the world a capacity of about ten million tons is installed or being installed.

I believe that United States applications Serial No. 206,147 and Serial No. 547,233 clearly discloses our method and the novel and essential details thereof. The important feature of the invention resides in controlling the force of the oxygen jet vertically impinging on the bath surface to cause a limited center of reaction to be created in the surface layer and to avoid deep penetration into the bath, whereby an automatic circulatory

movement is obtained in the converter vessel, and the entire charge is refined by the oxygen molten metal reactions in the limited center and the slag-metal reactions in the bath surrounding the reaction center.

I believe that the disclosure of the United States application is sufficient to enable the man skilled in the art to determine the type and dimensions of the nozzle, the oxygen pressure and the distance between the nozzle and the bath for any specific type or size of converter so that an adequate amount of oxygen is supplied to the converter while avoiding deep penetration of the bath.

Inasmuch as our concept of avoiding deep penetration of the molten metal with the oxygen blast is just the opposite of the methods disclosed in the Schwarz and Miles et al. patents and constitutes a major technical advance in the manufacture of steel from crude iron, I believe that our method is patentable,

FRANZ RUDOLF RINESCH

PX-2A, pp. 88-92.

Hauttmann Affidavit Filed June 11, 1957

[PX-2A, pp. 88-92]

IN THE UNITED STATES PATENT OFFICE

Applicant	:	Theodor E. Suess et al
Serial No.	:	547,233
Filed	:	November 16, 1955 Div. 3
For	:	METHOD OF CARRYING OUT MELTING PROCESSES

AFFIDAVIT

I, HUBERT HAUTTMANN, being sworn, declare that I studied at the Technical College, Vienna and the Mining College, Leoben, and I obtained my engineering degree in 1921 and my doctor's degree in December 1942;

I have been a lecturer at the Mining College in Leoben since 1950;

I have had more than thirty-five (35) years of experience in the field of research and testing of mining and smelting products of all kinds, particularly steel, and that I have been active in the steel industry for aproximately forty (40) years;

Since January, 1948, I have been a director of VEREINIGTE OSTERREICHISCHE EISEN - UND STAHLWERKE where I manage the Testing Institute and the Research and Quality Control Department; and

I am one of the inventors of the method disclosed and claimed in U. S. patent applications Serial Nos. 206, 147 and 547,233; Theodor E. Suess (deceased), Her-

PX-2A, pp. 88-92.

bert Trenkler and Rudolf Rinesch are joint inventors of the method described in U.S. patent applications Serial Nos. 206,147 and 547,233.

The technological conditions as expressed in the Schwarz German patent No. 735,196 and Miles French patent No. 933,098 which make conversion of crude iron to steel conditional upon the deep penetration of the oxygen stream into the bath, were known to me prior to 1949. The patentees intended the oxygen to be carried to all parts of the bath by the agitation or stirring produced by the deep penetration of the bath by the oxygen jet. Thereby the reaction of the oxygen with the crude iron was intended to take place within and throughout the bath by the oxygen seeking out the impurities. Furthermore, through Lellep's tests at the Gutehoffnungahütte, Germany, I was familiar with the effect of pure oxygen in the interior of a bath, although in those tests the oxygen was blown into the bath from the bottom. In view of the fact that in accordance with known technology prior to 1949, nobody had as yet succeeded in carrying through a commercially satisfactory steel manufacturing method involving the blowing of molten crude iron from above with a stream of oxygen, Messrs. Suess, Rinesch, Trenkler and I started our work in 1949 on the development of a method of refining crude iron with oxygen by utilizing the conditions suggested by Schwarz and Miles. In order to assure penetration of the jet into the bath, we selected for tests on June 17, 1949, a Laval nozzle of about 8 mm, inside diameter which was arranged at a short distance, e.g., 10 cm. from the surface of the bath and an oxygen pressure of eight atmospheres gauge. After a few tests

conducted with a converter having a two-ton capacity, it became clear that deep penetration of the bath by the oxygen jet with agitation producing injury to the lining and its consequent interference with the refining action, must be avoided if we were to obtain a high quality iron or steel and, at the same time, have a satisfactory operating life for the lining of the converter. We then selected different blowing conditions whereby the stream of oxygen does not agitate or stir the bath materially. The new blowing conditions produced highly satisfactory steel and with a very substantial reduction of the erosion of the lining of the converter. An occasional experimental run did not give the expected results, but the majority of the experiments thereafter were successful because we had now determined that a satisfactory refining operation of the entire bath could be obtained so long as we relied mainly upon induced circulation due to a localized reaction center as distinguished from relying upon the stirring action of the oxygen jet penetrating deeply into the bath. While the advantages of the new method were appreciated at once, a completely satisfactory explanation for the improved results was not readily apparent. However, as the result of greater experience with the method as used in commercial production, I am convinced that an essential characteristic of our method is that a limited center of reaction is created in the bath by blowing oxygen onto the surface through a nozzle which is placed at a considerable vertical distance from said surface, said center of reaction being spaced laterally from the side walls and vertically above the bottom wall substantially in the surface layer and that agitation such as is caused by the deep penetration of the jet

according to the methods of the prior art, together with injury to the lining, and interference with the refining action thereby are avoided. Moreover, with the deep penetration method, more oxygen per unit of time per unit of surface area of the bath is furnished than the surface layer of the bath is able to absorb, with consequent reaction of the excess deep within the bath, while in our method the amount of oxygen supplied per unit of time per unit of surface area for elimination of the impurities does not greatly exceed the amount that the reaction center on the surface layer of the bath can absorb.

Another difference between the method discovered by us and the prior method is that the force of the oxygen jet vertically impinging on the bath surface is controlled to avoid uncontrolled agitation or stirring of the bath whereby an automatic circulating movement is obtained in the converter vessel, and the entire charge is refined by the oxygen-molten metal reactions in the limited center and the slag-metal reactions in the bath surrounding the reaction center. As a result of the heat being generated by the burning of iron and the impurities in the reaction zone in the surface layer of the bath, completely different temperature conditions result as compared with the temperature conditions produced by blowing the oxygen deeply into and stirring the molten metal with the oxygen jet. When the reaction takes place deeply within the bath, the heat generated raises the temperature of the metal generally and it and the highly heated gases are brought violently into contact with the refractory lining. Thus, the temperature difference between the center of the reaction

and the remainder of the bath is substantially less than in our process where the reaction takes place principally in a zone in the surface layer of the bath, creating a very high temperature near the slag to promote an early fluid slag and also resulting in lower metal temperature in the other portions of the bath which protects the lining thereby avoiding the injurious effects brought about by deep penetration of the bath when following the methods taught by the prior art.

Inasmuch as our concept of securing purification of the entire contents of the bath mainly by the controlled circulation induced by the reaction center is just the opposite of trying to carry the oxygen to all parts of the bath by agitation produced by deep penetration, as by the methods disclosed in the Schwarz and Miles patents, and constitutes a major technical advance in the commercial manufacture of steel from crude iron, I believe that our method is patentable.

HUBERT HAUTTMANN

DX-61, Tab 8.

Translation of Schwarz German Patent No. 735, 196, Published July 3, 1943

[DX-61, Tab 8]

[Agreed Translation Nov. 30, 1962]

GERMAN REICH
PATENT OFFICE OF THE REICH
PATENT NO. 735,196
Class 18 b Group 8
B 187456 VIa/18 b

Inventor: Dr. Carl Schwarz of Berlin.

Applicant: H. A. Brassert & Co. of Berlin-Charlottenburg.

METHOD OF TREATING LIQUID BATHS, FOR INSTANCE METAL BATHS, WITH GASES

Patented in the German Reich as from May 24, 1939.

Allowance of the patent made known on April 8, 1943.

Pursuant to Article 2, Paragraph 1 of the Ordinace of July 20, 1940, the declaration has been submitted that the protection of the patent is to extend to the Protectorate of Bohemia and Moravia.

Published on July 3, 1943.

If liquid baths, for instance metal baths are to be treated with gases, it is important to bring the reactants into as intimate contact with each other as possible. Surface contact is not sufficient in most cases to produce a rapid reaction, such as the blowing of the gas over the surface of the bath or the mere blowing of the gas onto the surface of the bath. The blowing of the gas

through the bottom or wall of the container and the bath or the blowing of the gas into the bath by means of a pipe naturally results in substantially stronger contact of the reactants and thus a substantially faster reaction, but in many cases it cannot be employed for technical and practical reasons.

The object of the present invention is a method of bringing gases into particularly intimate contact with liquid baths, for instance metal baths, by providing the jet of gas directed onto the surface of the bath with such a high kinetic energy that it is capable of penetrating in the manner of a solid body deep into the bath by the use of extremely high velocities lying preferably above the speed of sound. In this way it is possible, without any addtional means, such as for instance a pipe or the like which is subject to rapid wear, to cause the jet of gas to act within the liquid baths so that the reaction takes place extremely rapidly and completely.

In the converter process, to be sure, it is known to use a high blast inlet velocity, possibly of a speed lying above the speed of sound, in order to conduct the air through the bath in as compact a jet as possible. Since in this case, however, the blast is introduced into the bath from below through the converter bottom, it was not possible to obtain from this proposal the idea, when treating liquid baths, for instance metal baths, with gases, to cause the jet of gas to impinge on the surface of the bath with such a high velocity that it was capable of penetrating into the bath in the manner of a solid body.

Nor is it any longer new to introduce liquid alkali compounds in the form of a thin stream under the action of high pressure vertically or obliquely into a metal bath. From the fact that a liquid jet can be imparted such a high velocity that it penetrates into a metal bath, it could, however, not be concluded by far that it would also be possible to conduct a jet of gas from above in such a manner onto a liquid bath that it was capable of penetrating into the interior of the bath.

This manner of procedure can be employed, however, with particular advantage in metallurgical processes, for instance for the treatment with gases of molten metals or slags. Thus, for instance, liquid blast furnace or other slags can be treated in the manner described with air, oxygen-enriched air or oxygen itself, in order to burn the sulfur and any other components which are still unoxidized, and thereby bring about a heating of the slag to higher temperatures. Further possibilities of use in the method in accordance with the invention consist of the blowing of carbon-containing gases into metal melts to effect carburization, or the blowing of steam into iron or steel melts, in order to effect so-called water-refining.

The method in accordance with the invention is particularly suitable, however, for the refining of iron and steel melts, and as a matter of fact, preferably with the use of oxygen-enriched blast or oxygen. In the refining of iron and steel melts one can, it is true obtain relatively high reaction velocities by the air blowing process in which air is blown through the wall of the vessel and the liquid bath. Even in the ordinary wind blowing process, however, the blowing bottom is that

part of the wall of the vessel which becomes most rapidly worn. When using oxygen-enriched blast, the action on the blowing bottom, due to the large local overheating and accumulation of ferrous oxide is even greater, so that the possible enrichment with oxygen finally finds a limit due to the excessively short life of the blowing bottom. In the case of laterally blowing converters, in which the blowing nozzles lie deep below the blowing surface, similar disadvantages occur. When the blowing holes are located only just below the surface of the bath or even above it, the disadvantage of excessive wearing of the bottom recedes, it is true, but on the other hand the utilization of the blast is extremely poor. Furthermore, there is frequently the drawback in this case that the wall lying opposite the blast inlet is too strongly attacked by the gases or by a flame formed by the gases.

In the refining of steel with oxygen-enriched air or oxygen, when using the method in accordance with the invention, the danger of rapid wear of the container liner is eliminated since the reaction between oxygen and iron or iron-accompanying substances with the phenomena resulting therefrom, namely local overheating and accumulation of ferrous oxide, takes place in the center of the steel bath and therefore the walls of the vessel are not substantially attacked. Accordingly, the invention for the first time makes possible in actual practice the use of very strongly oxygen-enriched blast or oxygen for the refining of steel. Refining with oxygen, however, results in exceptional advantages, namely the speed of refining or decarburization of steel melts can be very considerably increased and the thermal balance of the process becomes so favorable that one is not

restricted to furnaces in order to carry it out, but can carry it out just as well in unheated containers, and can utilize the excess heat for the melting down of scrap or for other purposes.

The method in accordance with the invention can also be used in the manner that pulverulent solids are introduced into the liquid bath by means of gases, a good distribution of these substances being thereby obtained, particularly in case of varying direction of the jet. The gas can in this case exert an action of its own on the liquid bath, but may also serve merely as vehicle and carrier for the solids.

Claims

1. Method of treating liquid baths, for instance metal baths, by gases directed against the surface, characterized by the fact that the jet of gas which is directed against the surface of the baths has such a high kinetic energy that it is capable of penetrating deep, in the manner of a solid body, into the liquid baths.

2. Method according to Claim 1, characterized by the fact that the jet of gas which impinges with high kinetic energy on the surface of the bath and penetrates into same serves as vehicle and carrier for solids which are to be introduced into the baths.

DX-61, Tab 9.

Translation of Miles Belgian Patent No. 468,316, Granted November 30, 1946

[DX-61, Tab 9]

[Agreed Translation November 2, 1962]

KINGDOM OF BELGIUM
MINISTRY OF ECONOMIC AFFAIRS
AND MIDDLE CLASSES

PATENT NO. 468316

Application filed on October 4, 1946

Patent granted by Ministerial Decree of November 30, 1946

SPECIFICATION
filed in support of an application
for
Patent of Invention
by
John Miles & Partners (London) Limited
for

IMPROVEMENTS IN METHODS OF REFINING METALS

British Patent Application of May 3, 1945, in the name of John Miles and British Patent Applications of June 15, 1945, and January 4, and 11, 1946.

The present invention relates to the refining of both ferrous and non-ferrous metals.

Many impurities which are present in metals are normally eliminated by oxidation when the metal is melted and air or oxygen is brought into contact with

the impurities so that they are eliminated in gaseous state or in solid state in the form of slag. The conversion of cast iron into steel is an example of this known process and the present invention, although not exclusively limited thereto, can be applied with particular advantage to such a method of refining.

In accordance with the invention, the refining process consists in injecting into the molten metal, by a blast, an oxidizing fluid at such speed that a sufficient proportion of the fluid penetrates into the metal to react there on the oxidizable impurities and eliminate them from the metal and this process is characterized by the fact that the fluid employed contains not more than 30% nitrogen and a quantity of oxygen between 70% and 98%.

The mixture of oxygen and nitrogen may be a gas or a liquid, each of them having its own advantages. Thus, for instance, one of the advantages afforded by the use of a liquid instead of a gas for the jet is that the liquid has a greater force of penetration into the metal; if desired, therefore, the projecting tuyere can be maintained at a greater distance from the metal. Another advantage results from the fact that the oxygen-nitrogen mixture is produced in liquid state during normal manufacture and can be transported and stored more economically than a gas.

The oxygen-containing fluid can be projected from top to bottom onto the surface of the metal to be treated at such speed that the major part of the fluid jet penetrates into the bath. The velocity of the fluid at the surface of the metal required to cause this substantially complete penetration must necessarily vary in accord-

ance with the circumstances in each case. In particular, it varies as a function of the viscosity and the density of the metal to be treated. It has been found, for instance, that a nozzle of 0.32 inches inside diameter, the tip of which is 6 inches above the surface of a bath of molten cast iron requires a gas pressure of 7 or 8 atmospheres to deliver about 10,000 cubic feet of gas per hour into the bath at a speed of about 1250 feet per second, this speed being obtained by a suitable profile of the nozzle. The speeds of this order of magnitude are desirable in order to obtain an optimum penetration and effect of the fluid, but lower speeds can be used, giving rise to a corresponding reduction of the oxygen production. The oxygen which is thus reflected can be used to burn the combustible gases produced, such as carbon monoxide, thus producing additional heat.

The high speed of the fluid jet has the effect that the source of chemical oxidation reactions is located within the bath at a good distance from the refractory lining of the furnace. These reactions are ordinarily exothermal, the heat developed being frequently the only heat necessary to maintain the metal at the desired temperature and fluidity. The fact that the reactions take place in the interior of bath assures the use of the developed heat to the maximum degree. Furthermore, the expansion of the gas as it leaves the nozzle serves to maintain the nozzle cold. The penetration of the jet also fulfills the useful function of agitating the bath so that the reactions take place uniformly and to the maximum extent. The course of the refining can be controlled by varying the inclination of the jet with respect to the surface or by varying the velocity of the gases or their composition.

One of the greatest difficulties which has been encountered up to the present time in the refining of metals by causing a relatively feeble current of air to pass through the metal is that the nitrogen and sometimes the hydrogen are absorbed and remain in the metal at the end of the refining operation. It has already been proposed to overcome this difficulty by using pure oxygen, but this idea has never been applied on a large scale due to the relatively high cost of pure oxygen.

However, it has now been found that if the fluid jet projected at high velocity into the metal is formed of oxygen which does not contain more than 30% nitrogen, practically none of said latter gas is absorbed by the metal. On the other hand, it has been found that it is too costly to employ a fluid containing more than 98% oxygen so that in effecting the present invention, the relation of nitrogen to oxygen in the refining fluid has been kept between 30/70 and 2/98.

The preferred percentage of nitrogen is between 5% and 25% and at the present time the cost of oxygen which contains this percentage of nitrogen is relatively low and does not prevent the industrial application of the invention.

If the invention is employed to convert cast iron into steel, air can be employed during the first part of the conversion operation until approximately half the carbon content has been oxidized, the blowing being terminated with oxygen which does not contain more than 30% nitrogen, in order to produce carbon monoxide bubbles which, upon rising through the metal, entrain all the nitrogen present in the metal or retained during the first part of the blowing.

The invention can be applied in various manners to the known Bessemer process, thus, for instance, in the customary basic Bessemer, the blasting can be effected until the end of the carbon flame period after which the converter is tipped downward, the air feed is cut off and a high speed jet of oxygen and nitrogen in liquid or gaseous state is projected in order to oxidize the remaining impurities, the liberation of heat being obtained in the customary manner. The jet is caused to penetrate the surface of the bath of molten metal in one or the other of the manners described above.

In accordance with a variant, the normal blasting of the Bessemer can be prolonged until the major part of the phosphorus has been eliminated, whereupon the converter is tipped from top to bottom, the slag is removed and a new quantity of carbon is added, in particular by the addition of cast iron or metal from the mixer; lime is added and, if desired, other fluxes, and the blasting is then continued for a few minutes with an oxygen-nitrogen jet of high speed so as to obtain a steel having a low nitrogen content. The processing of the steel is then continued until the desired composition is obtained by the addition of ferro-manganese, spiegel, aluminum, etc.

One or the other of these modifications in the Bessemer process leads to a steel, the nitrogen, sulfur and phosphorus contents of which are comparable to those from the Martin furnace or of electric steel.

The jet can be introduced into the molten metal either through the spout of the converter or through one of the tuyeres, whether the latter are contained in the bottom or in the sides of the converter. In the case

of a bottom-blown converter, a door can be provided in the bottom plate which is opened after the converter is tilted downward in order to permit the jet to pass through the tuyere holes.

It has been found that when the Bessemer process is modified from normal by the incorporation therein of the present invention, in other words when the normal blowing is replaced by a high speed jet of oxygen containing not more than 3% nitrogen, the phosphorus is substantially completely eliminated before the total elimination of the carbon. It follows that the modified process has the very great advantage of avoiding the necessity of recarburizing the metal at the end of the blowing. It becomes needless to provide the Bessemer with the usual bottom if the high speed jet is injected into the bath of molten metal through one or more tuyeres, the nozzles of which are located a few inches above the surface of the metal bath. In the known process, the nitrogen which passes through the bath absorbs a large part of the heat liberated, but in accordance with the present invention, as the quantity of nitrogen is very greatly reduced, there is a great saving in heat. The reactions are produced much more rapidly, which makes it possible to obtain higher temperatures. It follows that the process can be applied to the conversion of crude metals containing much smaller proportions of heat-liberating elements, such as silicon, carbon and phosphorus. As a variant, or in addition, the process can be used for crude metals containing much higher percentages of turning or cuttings in view of the fact that, as indicated above, nitrogen is not introduced into the metal and obviously no hydrogen since there is none in the jet.

In the manner in which converters operated up to the present time, it was not possible to add to the charge more than 5% scrap or other operating waste, although approximately 25% of the steel ingots obtained by this process come from the plant in the form of waste. It would be extremely advantageous for a self-sufficient plant to use all its own waste and that the present price of steel scrap, which is less than one-half that of cast iron, an even higher percentage of waste constitutes a further important advantage.

Therefore, another object of the invention is to provide a process for oxidizing the impurities contained in the metals which is not limited, as up to the present time, by the relative quantities of heat-generating elements in the crude metal, so that the process presents great flexibility in the sense that it can be used for charges where the relation of scrap to cast iron varies considerably, and the iron compositions of which are extremely different with respect to the above-mentioned heat-generating elements.

This purpose is obtained by adding to the bath either continuously or intermittently, while the jet is penetrating a heat-generating element, such as carbon.

This special process can be carried out in a closed furnace, with refractory linings, tilting or rotating and provided with outlets at its two ends for the escape of the gas burning above the metal. At each end, there are also provided one or more nozzles by means of which a mixture of nitrogen and oxygen can be projected at high velocity into the bath of molten metal resting on the hearth of the furnace. The cross-section

of the hearth is preferably elliptical or oval, its major axis being vertical and perferably longer than its horizontal axis, since this form has the advantage of giving rise to a roof or crown of relatively small span so that the charging can be effected from above, and therefore both the front and rear walls of the furnace may have a slope which is at present generally true only of the rear wall of the conventional type of Martin furnace. The hearth is provided at each end with a single regenerator through which the burned gases are circulated and in which the entering air for the combustion is heated. The reversal is effected at suitable intervals which, depending on the speed of the operation, may coincide with the charging.

The furnace is charged at the start with molten metal such as cast iron containing a relatively high proportion of carbon and/or other heat-producing elements, or else said metal may be melted in the furnace, after having been charged, by gas burners. By means of nozzles at one of the ends of the furnace, there is projected into the bath of molten metal a jet of fluid consisting preferably of a mixture of 10% nitrogen and 90% oxygen. The jet is directed from top to bottom upon the surface of the metal at a velocity which is sufficiently high to assure the penetration of almost all the fluid into the bath. The jet serves to maintain a vigorous agitation so that the oxidizing reactions follow one another in the interior of the bath at a very high speed and with a very high chemical yield of oxygen.

The silicon and the phosphorus pass into the slag while the carbon burns, producing carbon monoxide, which rises above the metal and the slag where it burns.

being converted into carbon dioxide with the air or oxygen or mixture of oxygen and nitrogen admitted at the inner end of the furnace. All of these reactions are exothermal and supply a part of the heat necessary to maintain the operation going. The scrap is charged into the furnace between its center and the outlet end during the blowing period.

The oxygen-nitrogen jet, together with a suitable slag removes a large portion of sulfur so that the direct addition of coal, coke or other carbonaceous material to the bath becomes possible. However, it is preferable that the carbonaceous material contain only a small amount of sulfur and volatile substances.

The carbon may be added to the bath, either continuously or intermittently and in quantity sufficient to supply, by its oxidation, the heat necessary to maintain the operation and melt the scrap added. The carbon added to the bath may come from a "massive electrode" of the Soderberg type which penetrates into the furnace through the roof at the end opposite the inlet end and consists of a carbonaceous material such as anthracite or coke, bonded by pitch or other similar substance arranged in a steel sheath and protected on the outside by a refractory lining. This electrode can be raised or lowered as desired through a water-cooled opening in the top of the furnace. In accordance with a variant, the carbon may be added to the bath in the form of pulverized coal injected into the furnace at high speed either together with the oxidizing fluid or by separate nozzles. Or else it may be projected into the metal by a centrifugal machine of the sand-blast type. In either of these two latter cases, the carbon may be

added to the bath on the same side of the furnace as the jet, but when "electrodes" are employed, it is preferable to cause the electrode to descend into the bath at the outlet end of the furnace so that it does not interfere with the jet.

When the carbon is immersed in a bath of iron or steel, it is known that the rate at which the carbon dissolves is a function of the carbon content of the bath; it is extremely fast at low contents and very slow when the carbon content of the metal approaches 3%.

For reasons of the metallurgical art, it is desirable to have a purifying boil of carbon monoxide to remove all the gaseous impurities. It is therefore desirable, in view of these two considerations, to maintain the carbon content at about 0.6% to 1% for instance during the phase of operations during which the carbon is added to the bath. At this strength, the carbon dissolves rapidly and when the addition is stopped, a sufficient quantity of carbon remains in the bath to produce a finishing boil at the end and assure the required carbon content at the end of the operation. The above indicated value of 0.6% carbon can be decreased of course if steel of low carbon content is produced. The carbon content of the bath can be regulated by the degree of admission of oxygen, the degree of admission of carbon and the frequency of the tiltings if the circulation of the bath is slight.

If in certain phases of the operation the combustion of silicon or phosphorus alone is produced, then, of course, there is no advantage in permitting air to pass through the vents, the degree of admission of air being a function of the degree of production of carbon monoxide.

During the operation the slag is maintained in the desired conditions by the addition of lime, iron oxide, fluorspar, alumina, silica and other fluxes. The lime is preferably crushed first of all to sizes of 2" to 4" and the fines removed.

The production of metal can be increased and also the temperature of the bath regulated by the addition of iron ores and iron oxides. This method of adjusting the temperature can be employed when sufficient scrap is not available to assure an adequate control of the temperature.

After the melting of the entire charge and the blowing until the desired carbon content has been obtained, the steel can be completed in the customary manner by the addition of deoxidizing agents and alloy elements.

The high speed jet causes a vigorous agitation and an entrainment of the slag in the body of the metal, thus assuring an intimate mixing and rapid reactions.

The effectiveness with which the carbon monoxide liberated is burned to form carbon dioxide is considerably increased by the action of the regenerators which reheat the combustion air. The furnace must be designed to permit the gases to remain in the hearth for a sufficient period of time to assure complete combustion in the interior of the furnace chamber.

The air vents are preferably so made as to direct the stream of air from top to bottom toward the adjacent end of the bath and along the surface of the slag and the metal. The nozzles are placed either alongside the air vents or through them (or in both these positions at once) so that the jets strike the bath as near

as possible to the side of the bath on which the vents are. This arrangement permits the carbon monoxide produced by the combustion of the bath to be brought into immediate contact with the heated air. It may be advantageous to withdraw the oxygen pipes which are not being used.

If desired, the operation can be carried out in an annular furnace provided with a central vertical shaft in which the scrap is melted, high speed jets of a mixture of oxygen and nitrogen being directed into the molten metal which is collected in an annular hearth surrounding the central shaft at a level located below the lower end of the shaft.

The process can also be carried out in a Bessemer converter, in a Martin furnace, in an electric furnace, or any other suitable furnace, whether or not provided with recuperators.

It will be noted that the process which has been just described is very flexible with respect to the selection of the ratio of scrap to molten iron, which makes it possible to take advantage of the prevailing price of scrap or iron. Furthermore, the consumption of fuel for the production of a Martin steel is considerably reduced.

In any of the above processes, the oxygen-nitrogen mixtures can be preheated with or without the help of the heat lost from the gases liberated during the main reaction. Besides, or at the same time, the crude metal can be preheated. The operation can be carried out in an electric arc furnace or in an induction furnace, the crude metal being preheated electrically, in which case —in addition to the blowing—the steel can be finished

by heating under a deoxidizing slag. By this method, there can be obtained ordinary and carbon steels of the same quality as electric steels.

The heat can also be produced by suitable additions either to the jet or to the metal.

Thus one can blow in, with the jet, or by other means, such as a separate gas feed, a readily oxidizable element (metal or alloy), that is to say an element which has a high heat of oxidation, such as carbon, silicon, aluminum, calcium, magnesium or other metals or alloys. The purpose in this case is to increase the temperature locally where the jet strikes the bath so as to bring about the oxidizing action more rapidly. These materials are preferably added in finely divided state, for instance in the form of crushed shavings or powder. These additions may, if desired, be introduced into the bath otherwise than by means of the jet.

Furthermore, there can be blown into the metal simultaneously with the jet a gaseous or liquid fuel, such as coke oven gas, generator gas, weak gas, oil or tar. The additional gas or liquid must be so directed that it burns with a part of the oxygen coming from the jet so as to increase the temperature locally.

In either of the two cases last mentioned, higher temperatures can be obtained or else the additions of scrap can be made in a body, in separate charges or continuously, during the blowing operation.

Or again, the steel shavings can be melted in a cupola or other furnace, in contact with carbonaceous materials and the jet blown in subsequently, the carbon absorbed in the cupola or other furnace being used as fuel during the blowing of the jet.

The jet may be such that it supplies excess oxygen so that it burns the carbon monoxide produced by the oxidation of the carbon and converts it into carbon dioxide on the surface of the slag or metal, thus producing an additional heat which can be used to melt a larger quantity of steel scrap. This result can be obtained by adjusting the angle or the velocity of the jet so that the entire oxygen-nitrogen mixture does not penetrate the metal, the excess or "reflected" oxygen serving to burn the carbon monoxide given off.

Fluxes, such as lime, limestone, fluorspar, alumina and silica can be added in order to form a slag to remove or neutralize the silica, the phosphorus pentoxide and any other product of the oxidation. One can also use the process which consists of preparing an initial slag to eliminate the silica and manganese oxide, the titanium or vanadium oxides, to remove the slag and then prepare a second slag to eliminate the phosphorus. A double formation of slag may also be effected to obtain steel of low phosphorus or sulfur content.

The slag may be prepared in advance if desired.

In each of these cases, the oxygen of the jet reacts not only with the constituent elements of the metal but also with the slag, thus increasing the oxygen content of the latter and therefore the oxidizing reactions in general.

The jet is established at any angle between 15° and 90° with respect to the horizontal, but preferably between 30° and 75°, while the distance from the jet to the metal and/or the slag should be between 1 and 20 inches, preferably between 4 and 12 inches.

As the volume of the slag and metal increases—by the addition of scrap—the level of the metal changes and the jet is made adjustable so that it can be maintained at a relatively constant distance from the metal bath.

The cross-section of the jet can be non-circular and have for instance a rectangular or flattened shape if necessary.

The jet may be protected against splatterings and frothing of the slag or the metal by means of a refractory metal tube or by a plastic refractory casing. The nozzle and the tubing are preferably made of a substance capable of withstanding oxidation which may be a metal or a refractory clay.

Several suitable jets located in the furnace can be used simultaneously and if desired each of them can be given a vibrating motion so as to cover a larger surface of the bath.

The jet serves to circulate and agitate the metal and the slag, which is useful if alloy elements such as nickel or molybdenum are to be added, and it assures the uniformity of the composition and the temperature throughout the bath.

The process can be applied to the refining of metals other than iron, for instance to the mixtures used for the blowing of molten sulfide baths, known as mattes, such as copper/iron sulfides or copper/nickel/iron sulfides in which the main impurities to be eliminated are the iron and the sulfur.

The jet blowing process described above can be used jointly with other known steel production or refining processes. For instance the jet can be used to melt or

reheat crude metal and the Martin process or the acid or basic Bessemer process can be used to complete the refining of the metal. On the other hand, the Martin process or the acid or basic Bessemer process can be used to reheat the metal after which the jet is used to refine the metal. In the case of the Martin process, the treatment of the metal may be completed by withdrawing the jet and again using the Martin process.

Or again the normal electrical process can be employed for melting the charge, whereupon oxidizing jets of high speed are blown into the metal to effect the main refining operations whereupon one can effect the deoxidation and the desulfurization in the normal manner in the electric furnace.

The present invention can be employed in its application to the normal Martin furnace not so much to improve the quality of the steel as in order to make the process less costly. Thus the time taken up for the conversion in the Martin furnace can be reduced to a very great extent by the introduction through the charging doors or through the rear wall of the furnace of jets of high speed which project an oxidizing gas into the metal bath during the carrying out of the normal Martin process.

In the following claims wherever mention is made of the projecting of a jet of fluid onto the molten metal, this expression must be considered to include the case that the jet actually strikes the slag at the surface of the molten metal and acts on the metal by passing through the slag and reaching the metal and/or by renewing the slag so as to regenerate or increase its power to act on the metal.

CLAIMS

1. A process for the refining of molten metal by the projecting of an oxidizing fluid into the metal at a velocity such that a sufficient proportion of the fluid penetrates into the metal to react therein with the oxidizable impurities of the metal and eliminate them, characterized by the fact that the fluid employed does not contain more than 30% nitrogen and a proportion of oxygen between 70% and 98%.

2. A process according to Claim 1, characterized by the fact that the oxidizing fluid is a liquid mixture comprising principally oxygen and nitrogen.

3. A process according to Claim 1, characterized by the fact that the oxidizing fluid is projected onto the surface of the metal bath to be refined through a nozzle at a certain distance above the metal.

4. A process according to Claim 1, characterized by the fact that the fluid is projected into the metal at a velocity which is not less than 1250 feet per second.

5. A process according to Claim 1, characterized by the fact that the metal is first of all treated by an oxidizing fluid containing more than 30% nitrogen and the refining is completed by means of a fluid which contains not more than 30% nitrogen and a quantity of oxygen between 70% and 98%.

6. A process according to Claim 1, characterized by the fact that a heat-generating substance such as a carbonaceous material is added to the metal before or while the oxidizing fluid is projected into the metal.

7. A process according to Claim 4, characterized by the fact that the carbon coming from a rod of carbonaceous material immersed in the metal is added to the latter before the end of the refining.

8. A process according to Claim 1, characterized by the fact that the oxidizing fluid is used as vehicle to bring a heat-generating substance such as a carbonaceous material into the bath.

9. A process according to Claim 1, characterized by the fact that metal scrap is added to the metal during the blowing.

10. A process according to Claim 1, characterized by the fact that the metal into which the blowing is effected consists of steel scrap melted in a cupola so as to absorb carbon, or contains steel scrap which has thus been treated.

11. A process according to Claim 1, characterized by the fact that the refining is effected in a Bessemer converter.

12. A process for the refining of molten metal, characterized by the fact that the metal is subjected to a preliminary blowing in a Bessemer converter in the known manner and is then subjected to the blowing in accordance with Claim 1.

13. A process for the refining of molten metal, characterized by the fact that the metal is subjected to blowing in a Bessemer converter until the major portion of the phosphorus is eliminated whereupon the slag is removed, a new quantity of carbon and then of lime is added, and the metal is refined in accordance with Claim 1.

14. A process according to Claim 1, characterized by the fact that the metal is refined by the ordinary process in a Martin furnace modified by the addition of one or more jets of an oxidizing fluid which is projected into the metal within the furnace so as to increase the speed of the refining.

15. A process according to Claim 1, characterized by the fact that the refining process is carried out in an electric furnace and that the treatment of the metal is completed under a slag with application of electric heating.

16. A process according to Claim 1, characterized by the fact that the blowing is effected reversibly as in the Martin furnace, in a furnace having a blast nozzle and a recuperator at each end.

17. A process according to Claim 1, characterized by the fact that the refined metals are alloys of copper or copper-nickel, obtained by the melting of sulfide mixtures.

Brussels, October 4, 1946.

John Miles & Partners (London) Limited

By: Office Kirkpatrick, H. & C. Plucker Successors. Its Attorney.

PX-353

SUMMARY OF DEPTH OF INDENT (PENETRATION) DURING INSPECTION HEATS AT McLOUTH

(Reblow excluded)

Heat No.	Minimum Indent			Maximum Indent			Average Indent	
	Time		Ins.	Time		Ins.	Ins.	% of Average Bath Depth
	Min.	Sec.		Min.	Sec.			
89285	5	40	0.9	20	10	5.9	3.5	7.8
89296	4	10	0.5	25	45	8.8	4.4	8.9
99042	4	50	3.1	9	35	12.6	8.8	21.4
99054	4	50	3.4	13	05	12.5	8.8	19.5
A4208	8-11	—	nil	27	00	5.2	1.9	3.3
A4209	7	50	1.1	24	00	7.7	4.4	7.7
A5013	22	00	nil	30	00	9.1	4.8	7.6
A5022	7-10	—	nil	34	00	8.9	3.6	5.8
18999	6	20	2.9	25	30	12.5	9.1	16.5
19000	8	20	2.9	22	30	12.4	9.2	16.1
27596	11	30	1.1	34	30	13.0	6.7	11.3
28463	5	00	3.8	8	00	12.3	9.2	15.3

AVERAGE INDENT FOR ALL HEATS — 6.2 ins.

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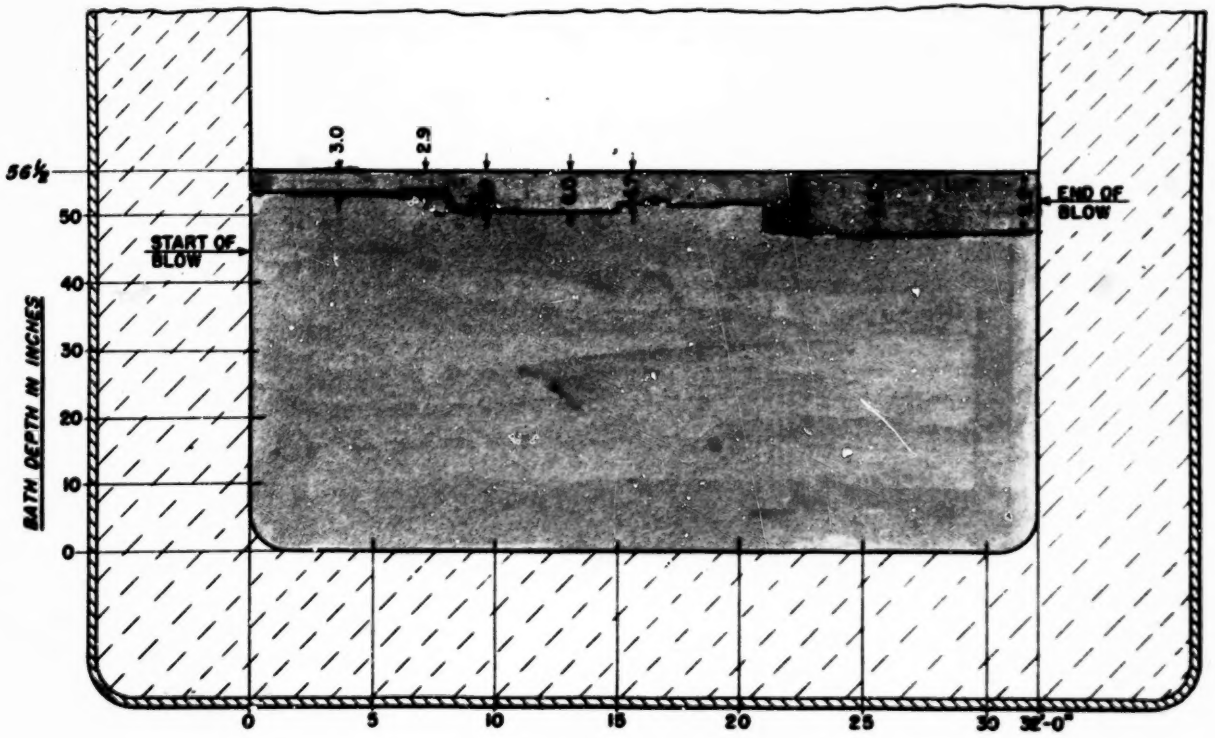
PLAINTIFFS' EX. 332

PX-332.

Depth of Indent (Penetration)
Shown in Relation to Bath Depth and Time of Blow
McLouth Heat No. A-4209-March 13, 1961 - OP-2



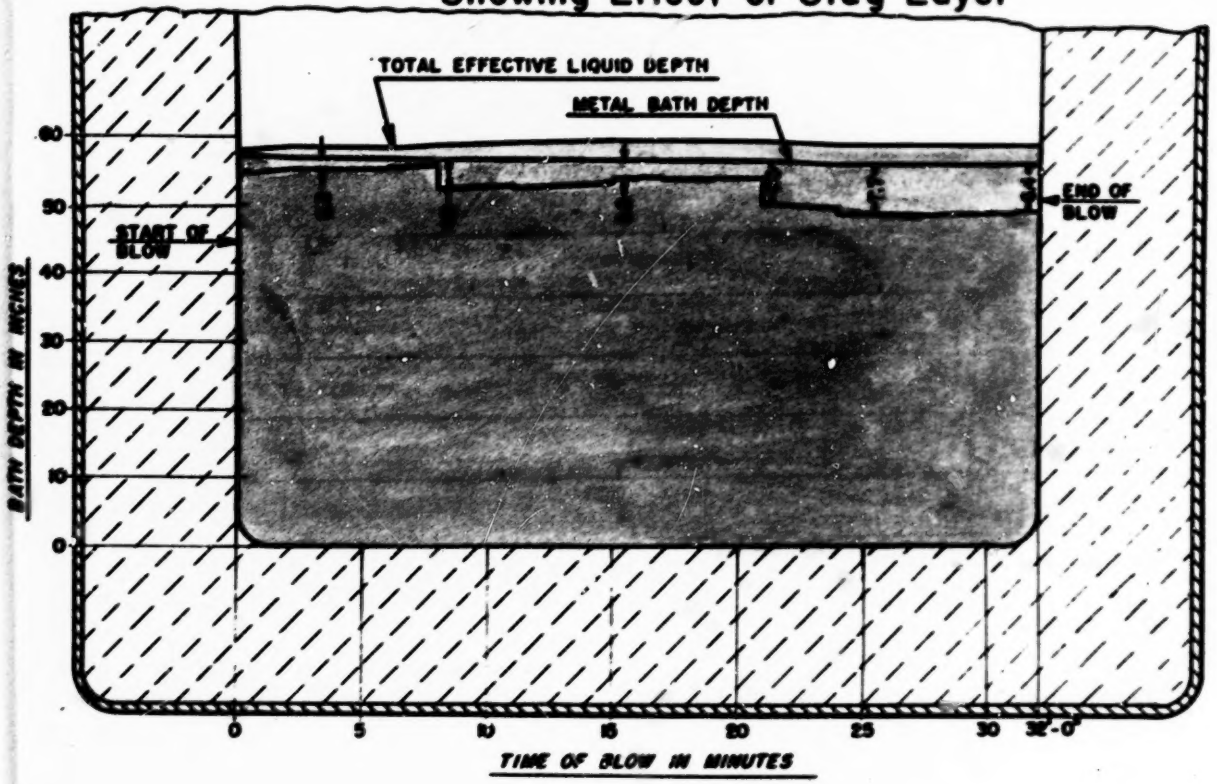
VIEW ILLUSTRATING "THE INDENT"

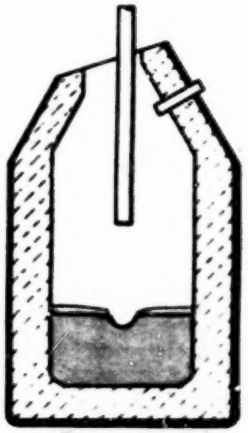
257a

KAISER et al. v. McLOUTH

PLAINTIFFS' EX. 351F

Depth of Indent (Penetration)
Shown in Relation to Bath Depth and Time of Blow
McLouth Heat No. A-4209—March 13, 1961—OP-2
Showing Effect of Slag Layer





VIEW ILLUSTRATING "THE INDENT"

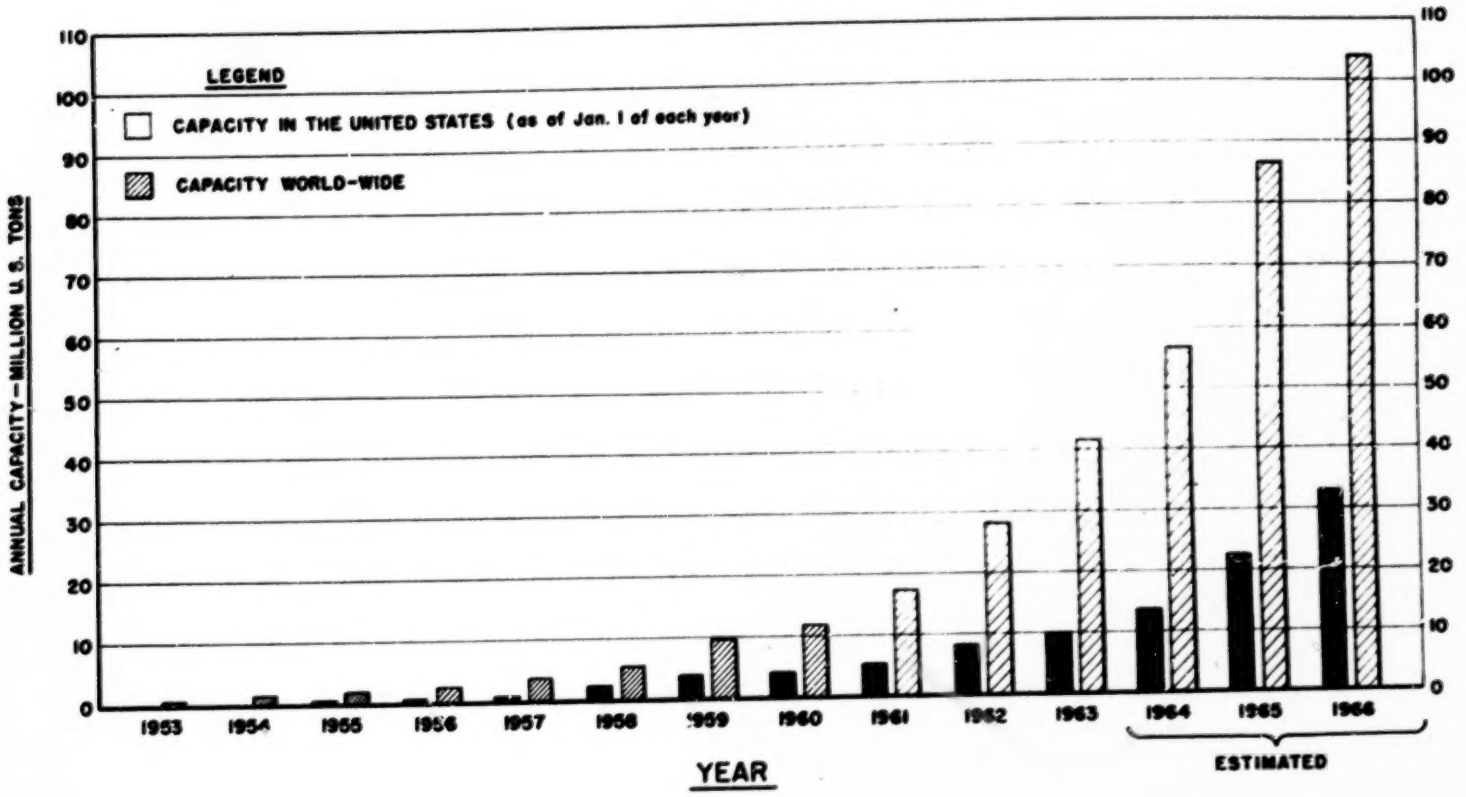
PX-351F.

259a

KAISER et al. v. McLOUTH

PLAINTIFFS' EX 82

L-D STEEL CAPACITY IN THE UNITED STATES AND WORLD-WIDE



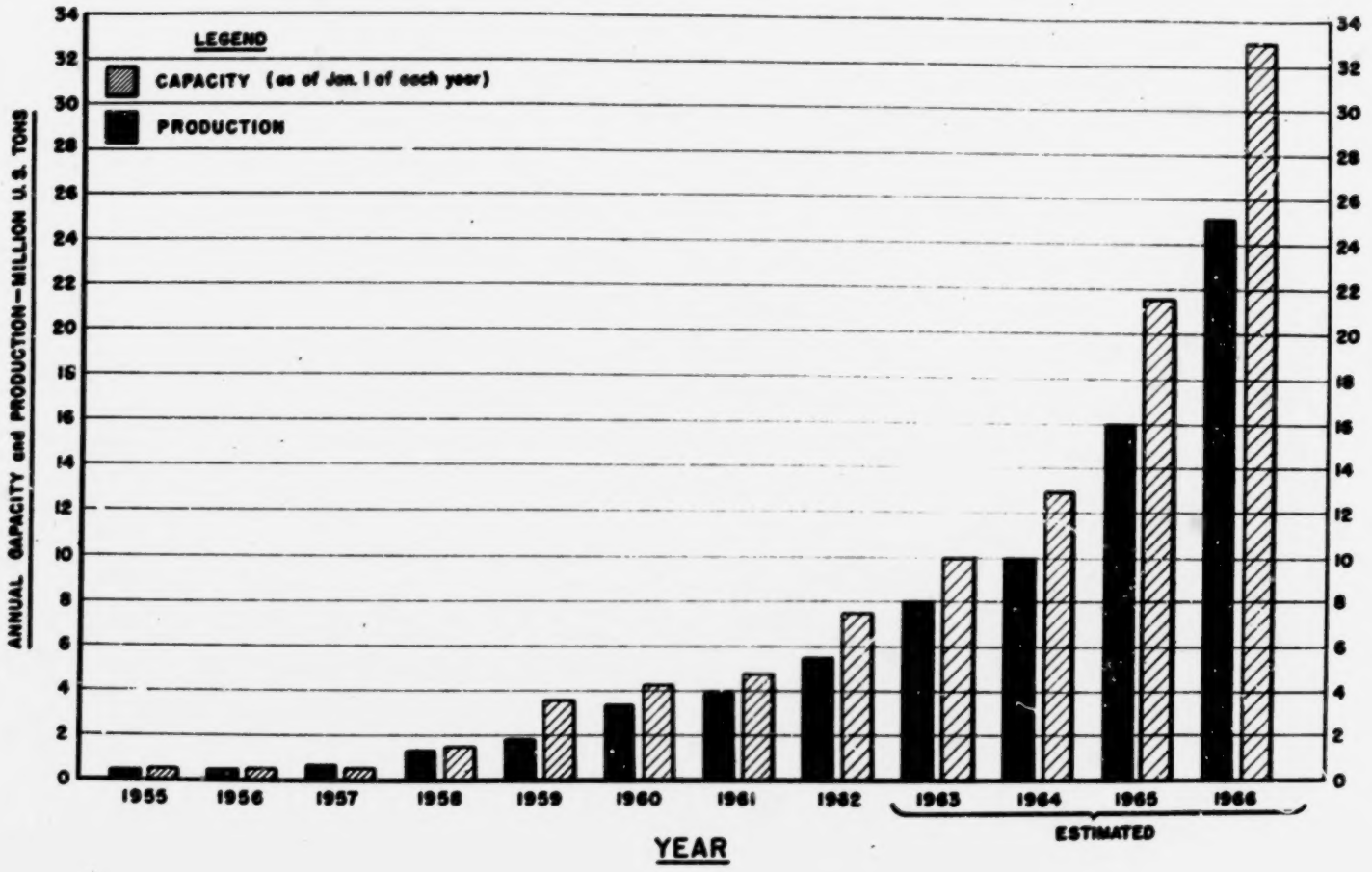
PX-82.

261a

KAISER et al. v. McLOUTH

PLAINTIFFS' EX 83

L–D STEEL CAPACITY AND PRODUCTION IN THE UNITED STATES



PX-83.

263c

PX-104.

L-D PROCESS NEWSLETTER

KAISER ENGINEERS DIVISION OF HENRY J. KAISER COMPANY • OAKLAND, CALIFORNIA

September 27, 1963
Newsletter No. 21

World-Wide Distribution of L-D Steel Plants

Annual capacity of L-D steelmaking plants in the United States has grown to 10 million tons, an increase of 33% from 7.5 million tons in July 1962. An additional three million tons is scheduled to go into operation by the first of next year, bringing total U.S. capacity to 13 million tons. By January of 1966, L-D plant capacity will have tripled today's tonnage, according to a recent survey by Steel Plants Development Department of Kaiser Engineers. At present, U.S. steelmakers are constructing 19 million tons of new capacity. This does not include plans of several other companies which could easily add 3 to 5 million tons to the 29 million ton figure projected for January 1966.

Use of the process for alloy steels as well as tonnage carbon steels is growing. Two companies have announced plans for using a significant portion of L-D production for alloy steels. Further, Republic Steel Corporation will be the first company in the United States to install a plant in the southern district. Their Gadsden, Alabama plant will be equipped to handle hot metal having phosphorus above the usual range used in this country.

Current production rates for L-D steel are running highe than those of the steel industry as a whole. Basic oxygen furnaces are operating at about 80% of capacity, compared with the industry operating rate of 70%. Cost advantages have had a large part in giving preference to L-D operations over open hearth. Current production figures indicate that 1963 basic oxygen production (including one Kaldo plant) will total about 8 million ingot tons, a 45% increase since 1962. This year's production will be slightly lower than that of the electric furnace's projected 11 million tons but should equal it in late 1964. Earlier predictions that L-D will equal open hearth production in the next decade still appear reasonable.

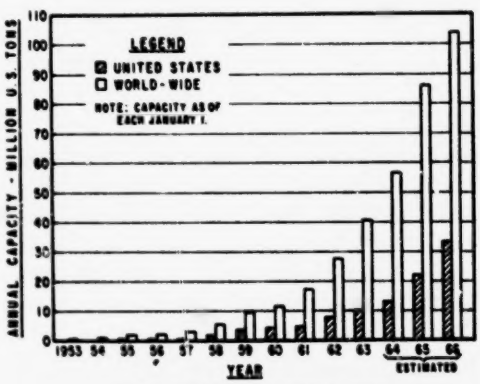
Steelmakers outside the United States are also increasing L-D capacity at a rapid rate. World capacity now totals 46.2 million tons, up 45% from July 1962. Future commitments indicate that world capacity will more than double by 1966 to over 100 million tons. The United States, Russia, West Germany and Italy will be major contributors to this future growth. The U.S. portion will climb from 25% to 32%. (See left graph on following page.)

In Europe, where high phosphorus hot metals are often used, lime powder injection techniques have been adopted in 13 plants and are planned in 12 more. European plants using Lorraine ores have pioneered this development. Japanese steelmakers have future plans to use the powder techniques.

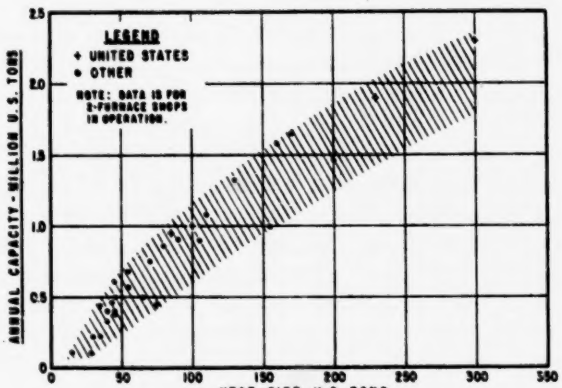
The listing of plants which follows indicates a trend toward large furnaces all over the world. The graph at the bottom right shows that the annual capacity of the operating plants reported increases almost in linear proportion to heat size. The spread of points, however, indicates the effect of raw materials, operating practices and product mix upon productivity.

J K Stone

J. K. Stone, Manager
Steel Plants Development Department



UNITED STATES AND WORLD-WIDE
L-D STEEL CAPACITY



EFFECT OF HEAT SIZE ON L-D PLANT CAPACITY

Company	Plant Location	No. of Furnaces & Output per Heat** (U.S. Short Tons)	Start-up Date	Annual Capacity** (U.S. Short Tons) Existing	Future Additions
UNITED STATES					
Acme Steel Co.	Riverdale, Ill.	2 x 75	1959	450,000	
Allegheny Ludlum Steel Corp.	Brackenridge, Pa.	1 x 20	1963		(Experimental)
Armco Steel Corp.	Ashland, Ky.	2 x 140	1963		1,400,000
Bethlehem Steel Co.	Lackawanna, N. Y.	2 x 250	1964/65		2,000,000
Colorado Fuel & Iron Corp.	Pueblo, Colo.	2 x 100	1961	1,000,000	
Ford Motor Co.	Dearborn, Mich.	2 x 240	1964		2,000,000
Great Lakes Steel Corp.	Ecorse, Mich.	2 x 300	1962	2,300,000	
Inland Steel Co.	East Chicago, Ind.	2 x 230	1965		2,000,000
Jones & Laughlin Steel Corp.	Aliquippa, Pa.	2 x 85	1957	950,000	
	Cleveland, Ohio	2 x 230	1961	1,900,000	
Kaiser Steel Corp.	Fontana, Calif.	3 x 110	1958	1,440,000	
McLouth Steel Corp.	Trenton, Mich.	3 x 60	1954)		
		2 x 105	1958)-	2,000,000	
		1 x 105	1960)		
Pittsburgh Steel Co.	Monessen, Pa.	2 x 150	1963		1,500,000
Republic Steel Corp.	Warren, Ohio	2 x 150	1965		1,500,000
	Gadsden, Ala.	2 x 150	1965		1,500,000
	Cleveland, Ohio	2 x 250	1965		2,000,000
United States Steel Corp.	Duquesne, Pa.	2 x 150	1964		1,500,000
Wheeling Steel Corp.	Steubenville, Ohio	2 x 225	1964		2,000,000
Wisconsin Steel Div. of International Harvester Co.	South Chicago, Ill.	2 x 120	1964		1,200,000
		TOTAL		10,040,000	18,600,000
ALGERIA					
Societe Bonoise de Siderurgie	Bone	3 x 65*	1965		990,000
		TOTAL			990,000
AUSTRALIA					
The Broken Hill Proprietary Co. Ltd.	Newcastle, N.S.W.	2 x 225	1962	1,280,000	
	Whyalla, S.A.	2 x 110	1964		560,000
		TOTAL		1,280,000	560,000
AUSTRIA					
Oesterreichisch-Alpine Montangesellschaft	Donawitz	2 x 35	1953	440,000	
Vereinigte Oesterreichische Eisen- und Stahlwerke AG	Linz	2 x 35	1952)		
		1 x 35	1956)-	1,540,000	
		2 x 55	1959)		
		TOTAL		1,980,000	
BELGIUM					
Forges de Clabecq S.A.	Ittre	2 x 65*	1964		500,000
Forges de la Providence S.A.	Marchienne-au-Pont	1 x 40*	1964		170,000
Genter Siderurgique Maritime Sidmar	Seckandi	2 x 200	1966		1,650,000
S.A. Acieries et Minieres de la Sambre	In planning stage	2 x 100*	1968		880,000
S.A. Cockerill-Ougree	Ougree-Seraing	1 x 65*	1963	200,000 (Experimental)	
		2 x 200*	1965		1,320,000
S.A. Metallurgique d'Esperance-Longdoz	Chertal	2 x 155*	1963	990,000	
Societe Metallurgique Hainaut-Sambre S.A.	Montignies-sur-Sambre	1 x 25*	1963	80,000	
		TOTAL		1,270,000	4,520,000

NOTES: * Furnaces equipped with facilities for lime powder injection through the oxygen lance.
** Furnace outputs rounded to the nearest 5 tons, annual capacities to the nearest 10,000 tons.

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Company	Plant Location	No. of Furnaces & Output per Heat** (U.S. Short Tons)	Start-up Date	Annual Capacity** (U.S. Short Tons) Existing	Future Additions
BRAZIL					
Companhia Siderurgica Belgo-Mineira	Monlevade	2 x 40	1957	330,000	
Companhia Siderurgica Mannesmann	Belo Horisonte	2 x 30	1963	220,000	
Companhia Siderurgica Paulista - COSIPA	Piacaguera	2 x 85	1964		880,000
Siderurgica Barra Mansa S.A.	Barra Mansa	2 x 15	1963/64		140,000
Usinas Siderurgicas de Minas Gerais S.A. - USIMINAS	Ipatinga	2 x 50	1963		550,000
		TOTAL		550,000	1,570,000
CANADA					
The Algoma Steel Corp., Ltd.	Sault Ste. Marie, Ont.	2 x 105 1 x 110	1958 1963	900,000	Under Constr.
Dominion Foundries & Steel, Ltd.	Hamilton, Ont.	1 x 85) 1 x 105)	1954/56/61	1,250,000	
		TOTAL		2,150,000	-
FINLAND					
Rautaruukki Oy	Raahe	2 x 55	1965		660,000
		TOTAL			660,000
FRANCE					
Forges de la Providence S.A.	Rehon	1 x 30*	1963	120,000	
Societe des Acieries de Pompey	Pompey	1 x 20	1960	70,000	
		2 x 60	1963		400,000
		2 x 95*	1964		550,000
Societe Metallurgique de Normandie	Mondeville	2 x 65*	1960	500,000	
Union Siderurgique du Nord de la France (USINOR)	Denain Dunkerque	2 x 140* 1 x 140*	1962) 1963)	2,200,000	
		TOTAL		2,890,000	950,000
GERMANY (WEST)					
AG der Dillinger Huettenwerke	Dillingen, Saar	1 x 35* 1 x 35*	1960) 1961)	220,000	
August Thyssen-Huette AG	Duisburg-Hamborn	2 x 200	1962	1,460,000	
Bochumer Verein fuer Gussstahlfabrikation AG	Bochum	2 x 45	1957	610,000	
		2 x 165*	1963)		2,380,000
Dortmund-Hoerder Huettenunion AG	Dortmund-Hoerde	1 x 165*	1964)		
Eisenwerk-Gesellschaft Maximilianshuette mbH	Sulzbach-Rosenberg	2 x 15*	1959	110,000	
Gussstahlwerk Witten AG	Witten (Ruhr)	1 x 40	1957	110,000	
Huetten- und Bergwerke Rheinhausen AG, Huettenwerk Rheinhausen	Rheinhausen	1 x 45	1960	260,000 (Experimental)	
		2 x 95	1963)		1,980,000
		2 x 95	1965)		
Huettenwerk Salzgitter AG	Salzgitter	1 x 55*	1962	400,000	
Ilseder Huette/Peine	Peine	3 x 75*	1964		1,210,000
Mannesmann AG, Huettenwerk Huckingen	Duisburg-Huckingen	1 x 45*	1960	220,000	
		2 x 170*	1965/66		1,300,000
Phoenix-Rheinrohr AG, Vereinigte Huetten- und Rohrenwerke	Duisburg-Ruhrort	1 x 95*	1962	460,000	
		TOTAL		3,850,000	6,870,000
GREECE					
Halyvourgiki S.A.	Elevsis	2 x 35	1963		280,000
		TOTAL			280,000

Company	Plant Location	No. of Furnaces & Output per Heat** (U.S. Short Ton)	Start-up Date	Annual Capacity** (U.S. Short Tons) Existing	Future Additions
INDIA					
Hindustan Steel Ltd.	Rourkela	1 x 55	1959)	1,120,000	
		2 x 55	1960)		
Mysore Iron & Steel Ltd.	Bhadravati	2 x 65	1966		900,000
		2 x 15	1963		130,000
		TOTAL		1,120,000	1,030,000
ITALY					
ITALSIDER S.p.A.	Bagnoli	3 x 140/165	1964		2,210,000
	Taranto	2 x 285/330	1964		2,480,000
	Piombino	2 x 140/165	1965		1,380,000
		TOTAL			6,070,000
JAPAN					
Amagasaki Iron & Steel Mfg. Co., Ltd.	Amagasaki	2 x 40	1960	400,000	
Fuji Iron & Steel Co., Ltd.	Hirohata	2 x 90	1960	900,000	
	Muroran	2 x 110	1961	1,080,000	
Kawasaki Steel Corp.	Chiba	2 x 170	1962	1,650,000	
Kobe Steel Works, Ltd.	Kobe	2 x 80	1962	860,000	
Nippon Kokan Kabushiki Kaisha	Kawasaki	2 x 55	1958	570,000	
		1 x 55	1964		570,000
	Mizue	2 x 85	1960)	1,540,000	
		1 x 85	1962)		
	Tsurumi	2 x 65	1963		890,000
Nisso Steel Mfg. Co., Ltd.	Toyama	1 x 5	1961	(Experimental)	
North Japan Special Steel Co., Ltd.	Hachinohe	1 x 10	1963	60,000	
Sumitomo Metal Industries, Ltd.	Kokura	2 x 55	1961	680,000	
	Wakayama	2 x 130	1963	1,320,000	
Tokai Iron & Steel Co., Ltd. (subsidiary of Fuji Iron & Steel Co., Ltd.)	Nagoya	2 x 150	1965		1,500,000
Toohoku Electro-Chemical Industries Corp., Ltd.	Gunma	1 x 10	1960	70,000	
Yawata Iron & Steel Co., Ltd.	Kukioka	2 x 70	1957	750,000	
		1 x 75	1964		880,000
	Tobata No. 1	2 x 75	1959)	1,760,000	
		1 x 90	1960)		
	Tobata No. 2	2 x 160	1962	1,580,000	
		TOTAL		13,220,000	3,840,000
LUXEMBOURG					
Acieries Reunies de Burbach-Eich-Dudelange S.A. (ARBED)	Dudelange	1 x 30*	1958)	460,000	
		1 x 55*	1962)		
	Esch-sur-Alsette	1 x 70*			390,000
		TOTAL		460,000	390,000
NETHERLANDS					
Koninklijke Nederlandsche Hoogovens en Staalfabrieken N.V.	IJmuiden	3 x 110	1958/61†	2,000,000	
		TOTAL		2,000,000	
NORWAY					
A/S Norsk Jernverk	Mo-i-Rana	1 x 45	1961)	500,000	
		1 x 45	1962)		
		TOTAL		500,000	

NOTE: † Original furnaces (2 x 65 tons per heat) installed in 1958 were replaced by the larger furnaces in 1961.

PX-104.

Company	Plant Location	No. of Furnaces & Output per Heat** (U.S. Short Tons)	Start-up Date	Annual Capacity** (U.S. Short Tons) Existing	Future Additions
PERU					
Sociedad Siderurgica de Chimbote S.A. (SOGESA)	Chimbote	2 x 30	1963		Under Constr.
		TOTAL			—
PORTUGAL					
Siderurgia Nacional, S.A.R.L.	Seixal	2 x 45	1961	390,000	
		TOTAL		390,000	
SPAIN					
Altos Hornos de Vizcaya, S.A.	Sestao	2 x 45	1963	400,000	
Empresa Nacional Siderurgica, S.A.	Aviles	2 x 70	1963		550,000
		TOTAL		400,000	550,000
SWEDEN					
Fagersta Bruks AB	Fagersta	1 x 20 1 x 35	1958) 1962)	110,000	
		TOTAL		110,000	
TURKEY					
Eregli Demir ve Celik Fabrikalari T.A.S. (Eregli Iron & Steel Mills)	Eregli	2 x 90	1965		470,000
		TOTAL			470,000
UNITED KINGDOM					
Colvilles Ltd.	Ravenscraig Works Motherwell, Scotland	2 x 110*	1963		780,000
Consett Iron Co. Ltd.	Consett, England	2 x 110			Under Constr.
Lysaght's Scunthorpe Works (Branch of G.K.N. Steel Co. Ltd.)	Scunthorpe, England	2 x 60*	1964		500,000
Richard Thomas & Baldwins Ltd.	Ebbw Vale, Wales	1 x 40* 2 x 40	1960) 1962)	560,000	
	Spencer Works, Llanwern (nr. Newport), Wales	3 x 125	1962	1,570,000	
Stewarts & Lloyds, Ltd.	Corby, England	1 x 110* 2 x 110*	1962) 1964)		1,680,000
		TOTAL		2,130,000	2,960,000
USSR					
Bakal Metallurgicheskiy Zavod (Bakal Iron & Steel Works)	Chelyabinsk (Urals)	3 x 110	1964		2,210,000
Krivorozhstal Met. Zavod (Krivoi-Rog Steel Works)	Krivoi-Rog (Ukraine)	4 x 45 3 x 110	1958 1965	1,320,000	2,210,000
Met. Zavod Imeni Petrovskiy (Petrovsky Iron & Steel Works)	Dnepropetrovsk (Ukraine)	3 x 30	1956	550,000	
Nizhniy-Tagilskiy Met. Zavod (Nizhny-Tagil Works)	Nizhniy-Tagil (Urals)	2 x 110	1963		1,100,000
Novolipetskiy Met. Zavod (Novolipetsky Iron Works)	Novo-Lipetsk (Central European Russia)	3 x 110	1964		2,210,000
Zhdanovskiy Met. Zavod "Ilycha" ("Ilych" Tube Rolling Works)	Zhdanov (Ukraine)	3 x 110	1964		2,210,000
		TOTAL		1,870,000	9,940,000
YUGOSLAVIA					
Rudnici i Zelezara Skopje	Skopje	2 x 110	1964		660,000
		TOTAL			660,000
		TOTAL, WORLD-WIDE		46,210,000	60,910,000

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STAHLWERKE AKTIENGESELLSCHAFT, AND
BRASSERT OXYGEN TECHNIK AG., *Petitioners,*

v.

MCLOUTH STEEL CORPORATION, *Respondent*

MOTION OF THE GOVERNMENT OF AUSTRIA FOR LEAVE TO FILE A BRIEF AMICUS CURIAE IN SUPPORT OF THE PETITION FOR A WRIT OF CERTIORARI AND BRIEF AMICUS CURIAE

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v.

MCLOUTH STEEL CORPORATION, *Respondent*

MOTION OF THE GOVERNMENT OF AUSTRIA FOR LEAVE TO FILE A BRIEF, AMICUS CURIAE, IN SUPPORT OF THE PETITION FOR A WRIT OF CERTIORARI

The Government of Austria moves this honorable Court for leave to file the attached brief, as *amicus curiae,* in support of the petition for a writ of certiorari

to the United States Court of Appeals for the Sixth Circuit.

In accordance with Rule 42 (1) of the Rules of the Supreme Court, the Government of Austria has sought and obtained the consent of petitioners to the filing of its brief. Consent was requested of respondent, but withheld.

The Government of Austria asks leave to file a brief, *amicus curiae,* in order to present and analyze the issues in this case from its point of view. One petitioner is an Austrian company owned by the Government. Participation by the Austrian Government is appropriate because the decisions below give rise to domestic and foreign policy problems for Austria.

The loss of revenues that would result from the decisions below will be borne in large measure by the Government of Austria and ultimately by the citizens of Austria. The Government of Austria estimates that, of the sums due from users of the invention in this country over the life of the patent, its share (by reason of its ownership of petitioner VOEST) would amount to some $133 million. To one familiar with the United States budget, this sum may not seem large, but it is staggering to the Government of Austria. It represents 4% of the national budget of Austria for 1968, and exceeds Austria's total annual exports to the United States. A loss of this magnitude, even over a period of years, is of major significance to Austria.

Austria, like the United States, is a member of international conventions relating to industrial property rights and hence is interested in the integrity of the international patent system. That system depends, in

large part, upon a rational, fair application of the patent laws of every member of the international patent community. The decisions below, if permitted to stand, will have repercussions extending far beyond the borders of the United States and Austria. They could stimulate a chain reaction of breached agreements, refusals to pay royalties, and litigation throughout the world. There is some indication that this reaction has begun.

Steelmakers of nations throughout the world have paid royalties for the use of the invention in question. Inventions are not accorded patent protection in the USSR; yet the USSR has paid substantial sums for the use of the invention. Only in the United States has the basic patent for the revolutionary L-D steelmaking process even been challenged. The Austrian Government would find it very difficult to explain to its citizens why, for what serious reason, the American steelmaking industry is, as the courts below found, exempt from payments for use of the invention.

The interests of the Austrian Government cannot be adequately presented by the parties, which are business corporations with no responsibilities for the foreign and domestic policy ramifications of the decisions below.

These considerations have led the Government of Austria to question in a brief, *amicus curiae,* the validity of the decisions below. To the Government of Austria it appears that those decisions, based on unnecessary technicalities, reflect an erroneous approach to fundamental questions of patent policy and are at odds with the patent laws previously prevailing in the United States.

For these reasons, it is prayed that the Court grant leave to file the attached brief, *amicus curiae.*

Respectfully submitted,

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BRASSERT OXYGEN TECHNIK AG., *Petitioners*,

v.

McLOUTH STEEL CORPORATION, *Respondent*

BRIEF, AMICUS CURIAE, SUBMITTED IN SUPPORT OF A PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE SIXTH CIRCUIT

To the Honorable Chief Justice and the Associate Justices of the Supreme Court of the United States:

The Government of Austria, *amicus curiae*, respectfully urges that a writ of certiorari issue to review the judgment of the United States Court of Appeals for the Sixth Circuit entered in this case on August 2, 1968.

THE OPINIONS BELOW

The opinion of the United States District Court for the Eastern District of Michigan is reported at 257 F. Supp. 372 (1966). The opinion is reprinted in Appendix A to the petition for a writ of certiorari, at pages 45a-204a. The opinion of the Court of Appeals for the Sixth Circuit is reported at 400 F. 2d 36 (1968). That opinion is reprinted in Appendix A to the petition at pages 1a-43a. Reference in this brief to the opinions below and to other material in the record will be given by citation to the Appendix to the petition.

JURISDICTION

The grounds of jurisdiction are set forth in the petition at page 2 and are adopted by reference here.

QUESTIONS PRESENTED

In 1949, four highly skilled Austrian researchers invented a new steelmaking process. The invention was revolutionary, a giant forward step in making steel. The invention was patentable. Patents for the invention have been issued in numerous countries. In 1957, a patent was issued by the United States Patent Office.

This United States patent was declared invalid in the courts below, not because it lacked intrinsic merit (patentability), but because of asserted deficiencies in drafting the patent itself. The grounds for invalidity were trivial compared with the consequences. They are at odds with the patent law decisions of this and other Courts and with the general trend of this Court's decisions away from unjustifiable technicality in all areas of the law. The ultimate question is:

> Whether it is the public policy of the United States under the patent laws to strike down or

> destroy highly meritorious patentable advances in the arts and sciences because of technical drafting errors even though the invention sought to be covered in the patent is fully and clearly described in the specifications and the file wrapper history of the patent.

Stated more narrowly, the questions presented are:

1. Whether full explanations in the Patent Office dossier pertaining to a patent (the "file wrapper history") can be referred to for purposes of measuring the claims against the requirements of 35 U.S.C. § 112.

2. Whether the doctrine of "file wrapper estoppel" may be invoked against a patentee who alters the wording of his patent application—though *not* the concept or invention—so as to deny him all right to his invention under 35 U.S.C. § 112, even though that invention is defined by the original wording in the specifications and file wrapper history.

CONSTITUTIONAL PROVISIONS AND STATUTES INVOLVED

These are set forth in the petition at pages 5-6. We reprint only a portion of the critical statute, 35 U.S.C. § 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

REASONS FOR GRANTING CERTIORARI

This is not an ordinary patent case. The patent in question is basic and has revolutionized the steel industry throughout the world. It was issued by the United

States Patent Office. It is owned by an Austrian company, which is in turn owned by the Government of Austria. The substantial revenues it would produce would benefit Austrian nationals.

The issues are narrow, clear, and legal. Although the physical and chemical questions are complex, the questions before this Court are not. The Court of Appeals did not understand the facts, but our concern here is that it misunderstood and misapplied the law.

The courts below would leave American steel companies free to exploit Austrian technology without compensation to Austria. The immediate impact of the decision would be to encourage other countries to ignore Austrian rights. More important, if, as we believe, the courts below have invalidated the patent through an incorrect approach to the patent laws, the courts of other countries may be encouraged to protect their own industries by treating in similar fashion patents owned by foreign nationals. It is not surprising that courts define and delimit the patent monopoly carefully. But the means of limitation chosen by the lower courts in this case places undue stress on technical rules of drafting to the detriment of important public policies. The case warrants review by this Court.

Moreover, the case falls squarely within the grounds specified in Rule 19 of the Rules of the Supreme Court for granting certiorari.

First, the decision of the Sixth Circuit stands in conflict with applicable decisions of this Court both in patent cases and more generally in a wide variety of cases holding that important rights will not be lost by

reason of unnecessary technicalities (see pp. 15-16, *infra*).

Second, the decision of the Sixth Circuit on the questions presented conflicts with decisions of other Courts of Appeals (see pp. 17-20, *infra*).

Third, the case presents an important question of federal law which has not been settled by this Court (see pp. 20-24, *infra*).

STATEMENT OF THE CASE

Amicus incorporates by reference the statement of the case in petitioner's brief, at pages 7-20. However, some additional background information may be useful.

The invention—the L-D steelmaking process—was patentable. The District Court said so flatly: "the 'new mental concept' of the patentees to avoid a deep penetration of the bath by the jet was a *patentable advance* in the art of steelmaking." (App. A, p. 166a; emphasis supplied.) The Court of Appeals assumed as much (App. A, p. 25a), similarly referring to the discovery as a "patentable advance." (App. A, p. 33a).[1]

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[1] The Court of Appeals curiously went to great lengths to discuss the issue of obviousness before concluding that "conflicts in the evidence . . . require factual determinations which are best entrusted to the District Court in the first instance, and which the District Court did not make in this case." (App. A, p. 25a). The issue of obviousness is not, at this stage, before the Court.

Nevertheless, *amicus* believes that the intimation in the Court of Appeals' opinion that the invention at issue might fail the obviousness test would, if left unchallenged, prejudice the Court's examination of the issues actually presented. Accordingly, in an appendix to this brief, *amicus* points to some major deficiencies in the Court of Appeals' treatment of the obviousness issue.

Pig iron is iron which contains impurities such as silicon, manganese, carbon, and phosphorus. These impurities must be materially reduced to make steel. The L-D process is a process for removing such impurities from pig iron. Like many pioneer inventions, the L-D process patent appears simple in retrospect. However, the problems it solved had defied solution for decades.

For years prior to discovery of the L-D process, it had been understood that impurities might be removed by blowing a stream of oxygen (or a mixture of oxygen and air) into a bath of molten pig iron. This thought goes back to 1850. As soon as high purity oxygen became available at low cost and in large quantities, many workers tried to use it in various ways to refine iron into steel. None, however, knew how to do it and their efforts failed.

If oxygen were introduced through the bottom of the vessel, the heat produced by the chemical reaction at the vessel bottom would destroy it. This happened in several early experiments. The same problem would arise if the oxygen stream were blown down from above too close to the vessel bottom.

On the other hand, if the oxygen stream were blown deeply into the bath from above—though not so deeply as to destroy the bottom—another difficulty would arise. Phosphorus could not be removed and hence the steel would be unsatisfactory.

Patentees found that it was essential that the oxygen penetrate the bath to a limited extent only; in other words, that it was essential to avoid having the oxygen jet penetrate deeply into the bath. When this is done, the stirring or circulation of the bath is brought about

by the chemical reactions that take place within the bath. All of the prior art workers believed and taught that the stirring or circulation of the bath had to be accomplished by the mechanical or physical action of the jet and that this required deep penetration of the jet. For this reason they all taught deep penetration. What had eluded prior art workers was that the common reliance on mechanical agitation was misplaced. The *chemical* reaction of the oxygen and molten metal —resulting from a metallurgically unforeseeable phenomenon—achieved the necessary result.

The discovery that a stream of oxygen directed only a relatively slight way into the vessel would purify the metal was revolutionary. The new process was without serious flaws. It suffered from none of the deficiencies of too deep penetration of the oxygen jet. It yielded high quality steel about 15 times more rapidly and far cheaper than the process that had previously been in common usage.

A patent for the invention was first sought in the United States in 1951. Amendments and redrafted applications were submitted over the next six years. Finally, in 1957, two weeks after the patent claims had been rewritten and explanatory affidavits filed by two patentees, the Patent Office issued a patent for the L-D process. The prior applications and affidavits were, of course, lodged in the file wrapper, the Patent Office's public dossier for each issued patent, which is available to the public from the moment a patent issues.

The invention was fully, clearly, and concisely described in the specifications (description) as required by 35 U.S.C. § 112. Also in accordance with 35 U.S.C. § 112, the specifications concluded with two claims "particularly pointing out and distinctly claiming the

subject matter" which patentees regarded as their invention.

The principal claim of the issued patent, the only one here in question, reads in relevant part as follows:

> Method of refining molten impure iron . . . which comprises discharging a stream of oxygen vertically downwardly . . . onto and below the surface of the bath at the central portion thereof, *to an extent to avoid material agitation of the bath by the oxygen stream,* the contact of the oxygen with the bath resulting in reaction of the oxygen with a portion of the iron and with the oxidizable impurities of the bath . . . said reaction producing a circulatory movement in the molten metal, which circulatory movement brings those portions of the molten metal bath which are remote from the reaction zone into the reaction zone whereby those portions are subjected to said reaction . . . . [Emphasis supplied.]

This entire case rests upon two determinations of the courts below with respect to this claim:

1. That the claim as a whole and the underscored passage in particular are not sufficiently clear to meet the test of 35 U.S.C. § 112;

2. That patentees cannot rely upon the file wrapper history (in particular two affidavits which clearly explain the invention and the terminology used in the claim) to supply the clarity allegedly lacking in the claim itself.

If the second issue is resolved in favor of petitioners, the first issue becomes irrelevant; the second issue is the only one presented to this Court. The decisions below hold that claims stand or fall on their own wording, regardless of the light shed on them by material in the file

wrapper; this is contrary to the decisions of other Courts of Appeals and to decisions of this Court. Moreover, it runs contrary to the trend of the law in the United States, as articulated by this Court, to the effect that valuable rights will not be made to stand or fall on insignificant and unnecessary technicalities. There is nothing inherent in the nature of patent law or the often complicated factual situations involved in patent cases that requires this trend of the decisions to except patent law. Finally, the decision finds no basis or support in public policy.

The proper test for measuring a patent claim against 35 U.S.C. § 112 is both a narrow, precise legal issue and a crucial one, to which this Court should now direct its attention. The courts, especially the courts below, are apparently confused as to the proper sources of guidance for construing patent claims. The circumstances of this case demonstrate that such confusion can wreak grievous damage. It is inconceivable that the drafters of 35 U.S.C. § 112 contemplated the interpretation which the statute received at the hands of the Sixth Circuit in this case. It is therefore important that this Court, which has not construed 35 U.S.C. § 112 for more than twenty-two years,[2] consider the issue, settle the law, and accord patentees an idea of what they may expect in the courts of the United States.

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[2] It appears that the last case directly concerned with the interpretation of patent claims with respect to 35 U.S.C. § 112 was *Halliburton Oil Well Cementing Co.* v. *Walker*, 329 U.S. 1 (1946).

ARGUMENT

I. THE APPROACH OF THE COURTS BELOW CONFLICTS WITH DECISIONS OF THIS COURT AND OTHER CIRCUITS AND IS UNSUPPORTED BY THE POLICIES OF 35 U.S.C. § 112.

The L-D process patent was obtained only after the patentees had amended their applications several times. The patentees repeatedly emphasized, as the gist of their invention, the "avoidance of [that] deep penetration" which characterized the failures of the prior art. Claims focusing on this characteristic were pending in the Patent Office when the patentees changed the terminology of their claim. In its final form, the claim does not use the phrase "avoidance of deep penetration." Rather, it refers to avoidance of "material agitation," and specifies that the oxygen is blown onto and below the surface of the bath "to an extent [depth] to avoid material agitation of the bath by the oxygen stream."

The specifications of the patent contain numerous references to "avoidance of deep penetration" and adequately define this term. And the affidavits of the patentees, submitted when the wording of the claim was last changed two weeks before the patent issued, make clear that the patentees considered it essential to avoid stirring (agitating) the molten metal by a deeply penetrating oxygen jet;[3] and that if deep penetration were

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[3] "[O]ur concept of securing purification of the entire contents of the bath mainly by the controlled circulation induced by the reaction center is just the opposite of trying to carry the oxygen to all parts of the bath by agitation produced by deep penetration, as by the methods disclosed in the [most relevant prior art] patents . . . ." Affidavit of patentee Hubert Hauttmann, App. B, p. 230a.

avoided, the problem of excess phosphorus would be avoided as well.[4] These affidavits, in other words, explain fully and clearly the concept of "avoiding material agitation" of the bath by the oxygen stream, and make absolutely clear that that concept, in the minds of the patentees, was the same as the concept of "avoiding deep penetration."[5]

So far as the patentees were concerned, the phrases were synonymous. *The question in this case is whether "avoid material agitation" should be interpreted to mean what the patentees intended it to mean and—in affidavits submitted to the Patent Office—said it meant: "avoidance of deep penetration."* If so, both courts below agreed or assumed that the patent claim is not invalid for failure to satisfy 35 U.S.C. § 112. (App. A, pp. 163a, 25a).

The Court of Appeals described the phrase "avoidance of material agitation" in the claim as "meaning-

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[4] "[A] deeply penetrating stream creates an uncontrollable turbulence in the bath. . . . Furthermore, the phosphorous cannot be slagged off." Affidavit of patentee Franz Rudolf Rinesch, App. B, p. 224a. It has long been common practice in the Patent Office to take such affidavits of patentees into account in deciding whether to issue a patent. See, *e.g.*, *In re Huntzicker*, 90 F.2d 366, 368 (CCPA 1937).

[5] The record does not disclose the reason for the change in the wording of the claims. It is worth noting that the patentees did not know precisely how the chemically induced circulation of the molten metal came about, or its relationship to mechanical agitation. The fact that patentees may not have understood precisely how their invention worked is, however, irrelevant to the validity of their patent. See, *e.g.*, *Diamond Rubber Co.* v. *Consolidated Rubber Tire Co.*, 220 U.S. 428, 435-36 (1911).

less." (App. A, p. 30a).[6] This is obviously overstatement. When the patentees applied for the L-D process patent,[7] the term meant something to those skilled in the art, to the patentees, and to the Patent Office. It clearly meant something to those skilled in the art because the Miles patent, a leading patent in the prior art, had explicitly indicated that an oxygen jet should penetrate the bath of molten metal deeply in order to obtain (mechanical) agitation of the molten metal.[8]

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[6] The Court of Appeals stated that "when read in light of the specifications, these claims would not describe a practically negligible penetration to one skilled in the art." (App. A, pp. 30a-31a). The Court derived the term 'practically negligible' from a statement made by attorneys in prosecuting the patent application.

The Court below appears to have been factually wrong in believing that patentees limited their invention to a process involving a "practically negligible" penetration of the oxygen jet. The belief rests on a single statement, extracted from a mass of material in which the attorneys for the patentees were trying to draw a clear line between the invention and the prior art. When the entirety of their submission to the Patent Office is considered, it becomes clear that they never intended—and the Patent Office never required—that the invention be limited to a process with a "negligible penetration" of the jet.

Moreover, the Court was legally wrong in its approach, see n. 14, *infra*.

[7] This is, of course, the relevant time for applying the test of 35 U.S.C. § 112, which refers, not to what the patentee might legally patent, but to "the subject matter which the *applicant regards* as his invention." (Emphasis supplied.) The test is thus to be applied by a court with reference to both the past and the subjective state of mind of the eventual patentee. See, *e.g.*, *Deller's Walker on Patents* § 242 (2d ed. 1965); *Application of Bridgeford*, 357 F. 2d 679, 682 (CCPA 1966); *cf.* Federico, *Commentary on the New Patent Act*, 35 U.S.C.A. 1, 25 (vol. 1 1954).

[8] The Court of Appeals correctly noted that the requirement of 35 U.S.C. § 112 that the applicant "particularly [point] out and distinctly [claim] the subject matter" is to be applied with reference to a reader of the claim who is skilled in the relevant art. (App. A, p. 31a). See, *e.g.*, *Deller's Walker on Patents* § 242 (2d ed. 1965); *Application of Isaacs*, 347 F. 2d 887, 892 (CCPA 1965); *Briggs* v. *M & J Diesel Locomotive Filter Corp.*, 342 F. 2d 573, 578 (CA 7 1965).

The term meant something to the patentees, who linked it in the affidavits they submitted to the Patent Office with the term "avoidance of deep penetration." And it meant something to the Patent Office, which issued the patent here in question as soon as an application containing the words "avoidance of material agitation" and affidavits explaining that the term meant "avoidance of deep penetration" were submitted.

To all concerned, the instruction to blow "to an extent to avoid material agitation" was equivalent to: "You are concentrating on the wrong thing when you direct the oxygen jet deeply into the molten metal to stir the metal mechanically."[9] Taken with the remainder of the claim, the phrase meant: "You can penetrate much less deeply and rely on a chemically induced reaction to stir up the bath." It is inconceivable that these explanations of "avoidance of material agitation" were unknown to respondent.[10]

In defending their patent against an attack based on 35 U.S.C. § 112 the patentees are legally and properly

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[9] The District Court suggested that the concept of a "material agitation" of the molten metal by use of an oxygen jet is highly improbable. (App. A, pp. 177a-185a.) Assuming that the concept is, for modern science, highly improbable, the point is irrelevant. As the foregoing discussion and notes 7 and 8 show, the test of 35 U.S.C. § 112 is to be applied (a) with reference to the time of the filing of a patent application, (b) with reference to the subjective understanding of the patent applicant, and (c) with reference to persons skilled in the relevant art.

[10] The District Court stated that "it is clear from the claims that the language concerning avoidance of material agitation must be read with reference to penetration by the jet . . . ." (App. A, p. 172a). "It is impossible to suppose that anyone who really wished to respect the patent would have any difficulty in identifying what the claim covered." *Musher Foundation, Inc.* v. *Alba Trading Co., Inc.*, 150 F. 2d 885, 889 (CA 2 1945).

entitled to the benefit of the light shed on their claims by the affidavits lodged in the file wrapper of the patent *and available to the public*. The Court of Appeals for the Sixth Circuit concluded, however, that the patentees were not entitled to the benefit of these affidavits:

> Appellants contend . . . that the phrase ["material agitation"] must be given the meaning attributed to it by the patentees as reflected in the affidavits of Dr. Rinesch and Dr. Hauttmann . . . . Appellants would have us . . . [permit] a patentee to give meaning to a meaningless term through affidavits submitted to the Patent Office and filed somewhere obscurely in the file wrapper history of the patent.
>
> The patent law does not require a prospective inventor to search so far in attempting to determine the scope of a patent and the areas left open for inventive inquiry. Section 112 provides that it is the claims that shall *particularly point out* and *distinctly* claim the subject matter of the patentee's invention. Certainly, terms used in the claims can gain meaning from the specifications or from the knowledge attributable to one skilled in the art. But a prospective inventor is required to go no further in attempting to determine the invention claimed and the areas foreclosed to future enterprise. [Emphasis in original.] (App. A, p. 30a)."

[11] Although the Court of Appeals noted that one might resort to specifications and the "knowledge attributable to one skilled in the art" to interpret claims, it did not make proper use of either of these sources of guidance. For example, the Court below apparently failed to take into account the fact that the term "avoidance of deep penetration" appears several times in the specifications—obviously in explanation of the term "avoidance of material agitation" used in the claim. And the Court of Appeals never adverted to the clear connotation which the term "material agitation" had—by reason of the Miles patent, for example—for those skilled in the art: agitation by means of a deeply penetrating jet.

No reasons for the quoted proposition were given and no authority cited. The statement on its face conflicts with the decisions of this Court and of other Circuits. Moreover, the Sixth Circuit's strict rule finds no support in the policies underlying 35 U.S.C. § 112.

A. The Decisions

In *United States* v. *Adams*, 383 U.S. 39 (1966), this Court considered the proper interpretation of patent claims. The Court declared it "fundamental that claims are to be construed in the light of the specifications and both are to be read with a view to ascertaining the invention." 383 U.S. at 49. In interpreting the patent claims there at issue, the Court relied not only on the specifications, but on letters written by the patentee soon after his patent application was filed. The Court concluded that "it is evident that respondents' present reliance upon [a particular] feature was not the afterthought of an astute patent trial lawyer." Statements in *Graham* v. *John Deere Co.*, 383 U.S. 1, 33 (1966) are to the same effect: "It is, of course, well settled that an invention is construed not only in the light of the claims, but also with reference to the file wrapper or prosecution history in the Patent Office."

The Court has often invalidated patent claims for failure to meet the test of 35 U.S.C. § 112. In such cases, however, it has asked whether the claims, when read in light of available guides to interpretation, are sufficiently clear and distinct to describe the extent of the patent; see, *e.g.*, *Halliburton Oil Well Cementing Co.* v. *Walker*, 329 U.S. 1 (1946); *United Carbon Co.* v. *Binney & Smith Co.*, 317 U.S. 228 (1942); *General Electric Co.* v. *Wabash Appliance Corp.*, 304 U.S. 364 (1938); or whether the patentee has attempted by a

deliberate choice of imprecise terminology to extend his monopoly beyond the patentable; see, e.g., *Graver Tank & Mfg. Co.* v. *Linde Air Products Co.*, 336 U.S. 271 (1949); *Lehigh Valley R.R. Co.* v. *Mellon*, 104 U.S. 112 (1881).[12]

The Court appears never to have suggested that the file wrapper history may not be considered, in an inquiry pursuant to 35 U.S.C. § 112, *when that history explains terms used in the claims and is itself as precise and clear as anyone could wish.* Thus, it has never condoned the stringent approach adopted by the courts below in this case. Its most recent decisions, in *Adams* and *John Deere*, require precisely the opposite approach. See also *McClain* v. *Ortmayer*, 141 U.S. 419 (1891); *Goodyear Dental Vulcanite Co.* v. *Davis*, 102 U.S. 222, 227 (1881).

Indeed, the clear trend of the Court's decisions generally points away from the conclusion reached by the courts below here. See, *e.g.*, *Maty* v. *Grasselli Chemical Co.*, 303 U.S. 197 (1938); *Conley* v. *Gibson*, 355 U.S. 41 (1957); *Foman* v. *Davis*, 371 U.S. 178 (1962); *Poultry Hatchery Corp.* v. *Skelly Oil Co.*, 390 U.S. 365 (1968); *Banks* v. *Chicago Grain Trimmers Ass'n*, 88 S. Ct. 1140 (1968); *Carafas* v. *LaVallee*, 88 S. Ct. 1556 (1968). These cases arise, of course, in areas other than the specific one in question here. But the teaching of these and similar cases is that parties will not be stripped of valuable rights on the basis of nice technicalities; that courts should, whenever possible, reach the merits of a case.

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[12] One writer summarizes the case law interpreting Section 112 as follows: "[I]n the final analysis, the attitude of the courts is that a patent claim must not cover more than the court feels that the patentee is entitled to." Note, *Patent Claim Construction and the Halliburton Oil Case*, 15 Geo. Wash. L. Rev. 202, 207 (1947).

The strict test applied below is contrary to decisions in other Circuits. In *Ross Incorporated* v. *W. E. Grace Mfg. Co.*, 351 F. 2d 208 (1965), for example, the Fifth Circuit declared that "every element of each patent claim is deemed to be material to the inventive concept and, of course, the Patent Office history is relevant if questions arise as to scope of interpretation of claims." 351 F. 2d at 213. See also *Abbott* v. *Baxter-tine Mfg. Co.*, 255 F. Supp. 890, 898 (U.S. D.C. N.D. Miss. 1966). In *Whitman* v. *Mathews*, 216 F. 2d 712 (1954), the Ninth Circuit noted that "the claims are to be interpreted, not only in the light of the specifications and drawings, but also with reference to the file wrapper history." 216 F. 2d at 715. The same Circuit commented in *Cutter Laboratories, Inc.* v. *Lypophile-Cryochem Corp.*, 179 F. 2d 80 (1949) that "[w]hile arguments in the file wrapper cannot be used to expand the scope of claims, they can be used to affirm a construction permissible by the wording of the claims, as according with the intentions of the inventor and the Patent Office." 179 F. 2d at 87. See also *Moon* v. *Cabot Shops, Inc.*, 270 F. 2d 539, 543-44 (CA 9 1959); *Stuart Oxygen Co.* v. *Josephian*, 162 F. 2d 857, 861 (CA 9 1947). And the Tenth Circuit, in *Texas Co.* v. *Anderson-Prichard Refining Corp.*, 122 F. 2d 829 (1941), adopted a similar approach: "Where the language of a patent is susceptible of a particular construction the Patent Office proceedings may be resorted to to determine whether that construction accords with the avowed intent of the parties to the contract [patentee and Patent Office]." 122 F. 2d at 840. See also *Chicago Pneumatic Tool Co.* v. *Hughes Tool Co.*, 97 F. 2d 945, 948 (CA 10 1938); *Skinner Bros. Belting Co.* v. *Oil Well Improvements Co.*, 54 F. 2d 896, 899 (CA 10 1931). Finally, the Court of Claims, in its recent de-

vision in *Autogiro Co. of America* v. *United States*, 384 F. 2d 391 (1967) discoursed at some length on "the necessity for a sensible and systematic approach to claim interpretation": "In deriving the meaning of a claim, we inspect all useful documents and reach what Justice Holmes called the 'felt meaning' of the claim. In seeking this goal, we make use of three parts of the patent: the specification, the drawings, and the file wrapper." 384 F. 2d at 397. See also *Purcell Marine Services, Inc.* v. *United States*, 377 F. 2d 580, 568 71 (Ct. Cl. 1967); *Kemode Mfg. Co.* v. *United States*, 347 F. 2d 315, 319 (Ct. Cl. 1965)."

[1] There are cases in other courts in which such explicit language is not used but the specifications, the drawings, other material in the file wrapper, or the prior art was consulted for the purpose of interpreting patent claims: e.g., *Cannon Products, Inc.* v. *Edward Don & Co.*, 388 F. 2d 540, 544 (CA 7 1968); *Application of Rubin*, 362 F. 2d 555, 561 (CCPA 1966) (specifications, drawings and affidavits); *Application of Hostettler*, 356 F. 2d 562, 566 67 (CCPA 1966) (affidavits); *Application of Cave*, 347 F. 2d 578, 580 (CCPA 1965) (specification); *Georgia Pacific Corp.* v. *United States Plywood Corp.*, 258 F. 2d 124, 136, 138 (CA 2 1958) (specifications and drawings); *Westinghouse Electric Corp.* v. *Hancock Chemical & Mfg. Co.*, 179 F. 2d 293, 296 97 (CA 3 1949) (specifications and prior art).

The following statement, from the decision of the Sixth Circuit in *Wiegand* v. *W. Bingham Co.*, 106 F. 2d 546 (1939), merits particular note:

> "We are aware that in some jurisdictions reference to file wrapper history to ascertain the meaning of claims is looked upon with disfavor except insofar as it covers the question of estoppel through rejected claims. [Citation omitted.] This is on the ground that it involves looking at preliminary negotiations in the interpretation of a formal document intended to be the final memorial of the parties' intentions. We have not so tightly closed the door to inquiry upon the precise concept of the inventor measured by his own representation. [Citations omitted.] We have noted expanding judicial view [*sic*] in construing private contracts so as best to effectuate the clear intention of the parties . . . [citing Professor Willis-

Some of the cases cited and quoted above do not arise specifically under 35 U.S.C. § 112. *Adams*, for example, focuses on obviousness. *Ross Incorporated* appears to deal chiefly with the doctrine of file wrapper estoppel. Nonetheless, we believe these cases are relevant and in sharp conflict with the decisions below.

If a Court may look to the specifications and letters from the patentee to determine obviousness, as in *Adams*, it should be able to do so for purposes of 35 U.S.C. § 112. A contrary view would mean that a patent upheld as nonobvious on the basis of such interpretive guides would have to be invalidated under 35 U.S.C. § 112. The same point can be made with respect to the file wrapper estoppel cases."

> tion, 3 Contracts, 1780) "The question the court is seeking to answer is the meaning of the writing at the time and place where the contract was made." Conceding that extrinsic aid to construction must be accepted with caution, yet where in the difficult art of claim draftsmanship terms employed in effort to avoid prior art [sic] are susceptible of construction transcending the clear limits of the inventive concept, there should be no more reluctance to search for precise meaning than in a private contract." 106 F. 2d at 548.

In light of the decisions below, it would appear that the door which the Sixth Circuit was not yet quite closing in 1939 has now been definitively shut.

" The proper remedy in a file wrapper estoppel case is to limit a claim to those concepts which the patentee is not estopped to assert, not *automatically* to declare the claim invalid. See, e.g., *Graham* v. *John Deere Co.*, 383 U.S. 1, 33 (1966); *Schriber-Schroth Co.* v. *Cleveland Trust Co.*, 311 U.S. 211, 220-23 (1940); *Yosemite Chemical Co.* v. *United States*, 360 F. 2d 948, 953-54 (Ct. Cl. 1966); *M.O.S. Corp.* v. *John I. Haas Co., Inc.*, 332 F. 2d 910, 912-15 (CA 9 1964). Once the claim is thus limited, it is absurd to strike it down because, on its face, it fails to "distinctly [claim] the subject matter." Of course the claims on their face do not "distinctly claim" the subject matter in a file wrapper estoppel case; the fact that they claim more than the subject matter is what file wrapper estoppel is all about.

If it is proper to look to specifications and the file wrapper history to determine the *extent of the invention*, it must be proper to look to those materials to ascertain the *meaning of the claim*. Thus, all of the statements of the Circuits quoted above are in direct conflict with the instant decision of the Sixth Circuit, which held that relevant portions of the file wrapper history—affidavits, in particular—could not be relied on to clarify patent claims for purposes of 35 U.S.C. § 112.

B. The Policies Underlying 35 U.S.C. § 112

There is a further consideration in this case at least as important as the conflict among the Circuits. To the Sixth Circuit's statement that "a prospective inventor is required to go no further [than the specifications and the prior art] in attempting to determine the invention claimed and the areas foreclosed to future enterprise" the obvious question is: Why not? There appears to be no good reason, statutory or otherwise, for limiting the sources of explanation of patent claims to the claims themselves, the specifications, and knowledge attributable to one skilled in the art. And there is no policy justification for invalidating patent claims which are clearly explained in other material in the file wrapper, especially when such an important patent is at stake.

Two primary policies behind 35 U.S.C. § 112 are cogently summarized in *Georgia-Pacific Corp.* v. *United States Plywood Corp.*, 258 F. 2d 124, 136 (CA 2 1958): "those skilled in the art must be able to understand and apply the teachings of the invention and enterprise and experimentation must not be discouraged by the creation of an area of uncertainty as to the scope

of the invention." See also *Jones Knitting Corp. v. Morgan*, 361 F. 2d 451, 454 (C.A. 3 1966). In *Chicago Steel Foundry Co. v. Riverside Steel Foundry Co.*, 132 F. 2d 812, 814-15 (C.A. 7 1943), the point is added that the patentee must "make his invention clear, and do so in such a way that his counsel cannot give a different meaning to his words before the Patent Office than he does before the courts." (See the reference in *Adams*, *supra* p. 15, to the "afterthought of an astute patent trial lawyer.")

None of these policies is served by the stringent decision of the Court of Appeals below. The policy of preventing a patentee from extending his patent monopoly in the courts after his patent issues does not require that affidavits in the file wrapper be ignored in interpreting claims. The two affidavits in this case were apparently instrumental in convincing the Patent Office to issue the patent; they should be primary source material for interpreting the claims. The patentee has no way to use them to broaden his patent monopoly.

Nor do the policies announced in *Georgia-Pacific* dictate that the affidavits be ignored. That case does not consider what sources may be consulted to establish the necessary clarity of patent claims. The approach adopted by the Court of Appeals in the instant case, ostensibly permitting resort in the 35 U.S.C. § 112 inquiry to "the specifications or . . . knowledge attributable to one skilled in the art" but not to affidavits in the file wrapper history, finds no support in *Georgia-Pacific*. The prior art knowledge imputed to patent researchers, see n. 8, *supra*, may be more difficult to obtain than material clearly set forth in the file wrap-

per. Moreover, those researching the true meaning of a patent—persons skilled in the art—presumably do research the entire file wrapper because any limitation they find there to restrict the claims accrues to their benefit by reason of file wrapper estoppel. See page 24, *infra*.

Further, even if patent researchers did not always search the file wrapper, the result in this case cannot be justified. Valuable, meritorious patent rights should not be invalidated on the basis of a policy designed to avoid inconvenience to patent researchers. Nothing in the statute or case law requires so draconian a remedy for so negligible a fault. The result is particularly incongruous here since the patentees rely on their affidavits, not to broaden or narrow their claims, but simply to interpret them. As the Sixth Circuit would have it, when a patentee states claims too broadly (the file wrapper estoppel cases) his claims are narrowed but not invalidated; when a patentee explains his claims through material in the file wrapper, he suffers total forfeiture.

Finally, the courts below failed to consider two crucial points, which have always been relied upon by courts interpreting patent claims. First, the I-D process patent was a pioneer patent (App. A, p. 202a) and as such qualified for the most liberal interpretation. See *e.g.*, *Smith* v. *Snow*, 294 U.S. 1, 14 (1935); *Corning Glass Works* v. *Anchor Hocking Glass Corp.*, 374 F. 2d 473, 476 (CA 3 1967); *McCullough Tool Co.* v. *Wells Surveys, Inc.*, 343 F. 2d 381, 401 (CA 10 1965). The rules of construction to be applied to such a patent are different from those applied to a patent in a

crowded field. See, e.g., *Gillette Mfg. Co. v. Textron, Inc., Homedite*, 337 F. 2d 833, 838 (C.A. 6 1964); Note, *Patent Claim Construction and the Halliburton Oil Case*, 15 Geo. Wash. L. Rev., 202, 206 (1947). The Court of Appeals failed even to advert to this distinction.

Second, the courts below failed to consider the obvious reason why the patent claims were framed as they were and the meaning they held for the steel industry. The record below and the file wrapper history of the I. D process patent make clear that the patentees and the Patent Office thought that the invention could be fully and clearly described by reference to "avoidance of material agitation." If there was ambiguity, it was corrected by the explanation in affidavits submitted to the Patent Office. Those affidavits show clearly both that the "ambiguity" in the claim was not an attempt to broaden the scope of the patentees' monopoly, and that the "ambiguity" was anything but ambiguous to patentees, to the Patent Office, and to persons skilled in the steelmaking art, such as respondent. Yet the courts below did not take these considerations into account. They treated the patentees as though they had deliberately tried to extend their patent monopoly and cast aside the patent claim as "meaningless."

The courts below did not apply 35 U.S.C. § 112 with a view to the policies behind that section and according to the rules which this and other courts have established to differentiate the more revolutionary and meritorious patents from others. The result was a mechanical, in-

sensitive, and unjustifiably harsh application of the statute.[15]

II. "FILE WRAPPER ESTOPPEL" IS NOT, ON A CORRECT ANALYSIS, INVOLVED IN THIS CASE AT ALL.

The nonstatutory doctrine known as file wrapper estoppel is succinctly summarized in the opinion of this Court in *Schriber-Schroth Co. v. Cleveland Trust Co.*, 311 U.S. 211, 220-21 (1940):

> It is a rule of patent construction consistently observed that a claim in a patent as allowed must be read and interpreted with reference to claims that have been cancelled or rejected and the claims allowed cannot by construction be read to cover what was thus eliminated from the patent. [Citations omitted]. The patentee may not, by resort to the doctrine of equivalents, give to an allowed claim a scope which it might have had without the amendments, the cancellation of which amounts to a disclaimer. [Citations omitted]. The injurious consequences to the public and to inventors and patent applicants if patentees were thus permitted to revive cancelled or rejected claims and restore them to their patents are manifest. [Citation omitted.]

The Court of Appeals referred to *Schriber* nine times in its discussion of file wrapper estoppel and proclaimed

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[15] We note, first, that the courts below did not even discuss the presumption of validity of issued patents, see 35 U.S.C. § 282, in their discussions of Section 112, and, second, that the laws of other nations, which require clarity and specificity in applications for patents, do not even permit a challenge to a patent, once issued, on the ground of lack of clarity or specificity. See, *e.g.*, Austrian Patent Law of 1950, para. 28; Harris, *Some Aspects of the Underlying Legislative Interest of the Patent Act of 1952*, 23 Geo. Wash. L. Rev. 658, 685 n. 134 (1955).

its agreement (Judge Edwards dissenting) with the District Court's conclusion that "*Schriber Co.* controlled the result concerning file wrapper estoppel." (App. A, p. 43a)

However, the reasoning by which the courts below reached this conclusion casts serious doubt on their understanding of both *Schriber* and the file wrapper estoppel doctrine. *Amicus* submits that file wrapper estoppel is not involved in this case.

The courts below, predetermining that the invention inhered in the phrase "avoidance of deep penetration," reasoned as follows: 1) the phrase had been present in certain claims submitted to the Patent Office, some of which that office rejected and others of which it did not act upon; 2) the claims of the patent as issued did not contain the phrase; 3) petitioners were therefore estopped to assert that the claims of the patent as issued cover the concept of "avoidance of deep penetration."

This reasoning adds nothing to the lower courts' discussion of the first issue, regarding 35 U.S.C. § 112, because both the specifications and the affidavits of patentees in the file wrapper refer, over and over again, to "avoidance of deep penetration." Indeed, as previously stated, the affidavits contain a full explanation of the relationship of the terms used in the claim of the issued patent and the term "avoidance of deep penetration." If, as *amicus* has urged above, the specifications and file wrapper history must be examined for the light they shed upon the claims, the term "avoidance of deep penetration" cannot possibly be deemed to have been abandoned or rejected. If there was no

abandonment or rejection, of course, there cannot have been an "elimination" within the meaning of *Schriber*.

More important, the reference in *Schriber* to cancelled or rejected "claims" simply cannot be a reference to a particular phrase or turn of words. See, *e.g.*, *McCullough Tool Co.* v. *Wells Surveys, Inc.*, 343 F. 2d 381, 403 (CA 10 1965). The file wrapper estoppel doctrine must refer to abandonment of concepts.[16] The doctrine is designed to ensure that patent protection extends only to what the patentee has claimed, no more and no less. The issue in this case, however, is not whether the claims as issued may be broadened or narrowed by reference to the specifications and file wrapper history but whether they may be clarified and interpreted by such a reference (in which case they describe a patentable invention).

It serves no purpose to proclaim that the sole patentable advance inheres in a certain phrase and then to decide that, because that phrase is not used in the claims, the patentee is estopped to point to the phrase by way of clarification. Such a conclusion could properly be reached only if the phrase, as used in the specifications and file wrapper history, described a concept different from the concept described by the claims. However, as this brief's discussion of the section 112 issue makes clear, all persons concerned—those skilled in the art of making steel, the patentees, and the Patent Office—believed at the time the patent for the L-D process issued that the two concepts were one and the same.

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[16] Subject matter." See *e.g.*, *Edward Valves, Inc.* v. *Cameron Iron Works, Inc.*, 286 F. 2d 933, 943 (CA 5 1961).

Thus, the file wrapper estoppel issue in this case adds nothing whatever to the issue regarding the proper interpretation of patent claims. To the extent that the file wrapper estoppel issue emerges as the independent question of estopping a patentee to rely on a given turn of words, without regard to the meaning of those words, the decisions of the courts below would appear to be misdirected.

III. CONCLUSION

For the foregoing reasons, *amicus* respectfully requests that the petition for certiorari be granted.

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APPENDIX

Under 35 U.S.C. § 103, a patent may not be granted if the improvement that it represents over prior art would have been "obvious" to "a person having ordinary skill in the art." On the other hand, 35 U.S.C. § 282 states explicitly that an issued patent "shall be presumed valid." The effect of these two sections, taken together, is that a party who is challenging an issued patent as obvious must rebut a presumption that it is nonobvious.

The Court of Appeals eliminated the presumption of validity of the patent at issue by ruling that the prior art Schwarz patent had not been considered by the Patent Office. (App. A, pp. 12a-13a). This ruling is demonstrably erroneous. The Schwarz patent was referred to by name in the amendment of the patent application of June 11, 1957, and an argument against its pertinence was submitted (App. B, pp. 214a-218a). Moreover, it was referred to in the affidavits of patentees Rinesch and Hauttmann. Those affidavits were submitted to the Patent Office for the specific purpose of distinguishing the amended claims that were filed simultaneously with the affidavits from the most relevant prior art patents (Schwarz and Miles). (See App. B, pp. 219a-230a).

To hold, as the Court of Appeals has, that these affidavits were "off-hand" (App. A, p. 13a, n. 6) and thus ineffective to bring their contents to the attention of the Patent Office, merely because they were submitted only two weeks before the issuance of the patent, is clearly wrong. The affidavits were filed concurrently with the amended claims—the claims which are the crux of the patent that finally issued. To conclude, while thus discounting the basic support of the amended claims, that the changed language of the amended claims is so significant as to bring into play the doctrine of file wrapper estoppel against the patentees (see pages 24-27, *supra*) is so inconsistent as to be unfair. Yet that is precisely what the Court of Appeals has done here.

This is only one of several shortcomings in the Court of Appeals' discussion of obviousness. In holding that the patent at issue was not obvious in light of the Schwarz and Miles patents, the District Court found that the Schwarz and Miles patents were inoperable. (App. A, p. 73a, *et seq.*; p. 83a *et seq.*). This finding is vitally important because "an *inoperable invention* or one which fails to achieve its intended result does not negative novelty." *United States* v. *Adams*, 383 U.S. 39, 50 (1966). The Court of Appeals, however, flatly rejected this finding of the District Court. (App. A, pp. 17a-18a). In doing so, it rejected the results of certain unsuccessful experiments performed on the basis of the prior art patents. Because those experiments had been unsuccessful, the Court of Appeals concluded that they had not followed the teaching of Schwarz and Miles and, hence, had not demonstrated them to be inoperable. (App. A, pp. 17a-18a, n. 8). The weakness of this reasoning is that it assumes that what Schwarz and Miles taught was the equivalent of what could be done by following their teaching.

The experiments in question were carried on by Drs. Durrer and Hellbruegge. Respondent called these two men as witnesses in an effort to show that they and not the patentees were the actual inventors of the L-D process. In his testimony, Dr. Durrer claimed that the Schwarz patent "contained his ideas." (App. A, p. 120a). Although the District Court made no specific finding to the effect that Dr. Durrer was the originator of the ideas contained in the Schwarz patent, the District Court did conclude, and respondent conceded, that Drs. Durrer and Hellbruegge were practising the teachings of the Schwarz and Miles patents in their experiments. (App. A, p. 119a). No evidence was presented by respondent in this case to show that satisfactory results had ever been obtained by following either the Schwarz or the Miles patent. On the contrary the testimony of respondent's own witnesses shows that these patents were in fact inoperable.

These failures on the part of experts utilized as witnesses by the respondent, coupled with the absence of any other evidence that other steelmakers were able successfully to practice the teachings of the Miles and Schwarz patents, provide substantial evidence in support of the District Court's conclusion that the Schwarz and Miles patents were inoperable.[17]

The Court of Appeals had no evidence before it to show the operability of the prior art patents and hence, under Rule 52(a) of the Federal Rules of Civil Procedure, had no basis for rejecting the trial judge's findings of fact as "clearly erroneous." The Court of Appeals' failure to observe the standards laid down by Rule 52 for review of lower court findings compounds the error of its refusal to apply the presumption of validity provided by section 282. The result was that the Court of Appeals created, in effect, a presumption of *invalidity* for the patent involved in the present suit, a presumption wholly at variance with both the statute, 35 U.S.C. §§ 103, 282, and the case law interpreting the statute. See, *e.g.*, *Murray Co.* v. *Continental Gin Co.*, 264 F. 2d 65, 69 (CA 5 1959).

The Court of Appeals initiated its discussion of obviousness with a disclaimer of "familiarity" with the steelmaking art. (App. A, p. 9a). That disclaimer, in conjunction with the foregoing summary of major errors in the Court of Appeals' discussion of the issue, should counsel caution in any examination of that discussion.

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[17] The undisputed evidence also shows that when the patentees tried to follow Durrer, Hellbruegge, Schwarz, Miles, they failed to make satisfactory steel and never did succeed in making satisfactory steel until discovering their new concept.

SUPREME COURT, U. S.

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IN THE

Supreme Court of the United States

October Term, 1968

No. 948

KAISER INDUSTRIES CORPORATION,
VEREINIGTE OESTERREICHISCHE EISEN-UND
STAHLWERKE AKTIENGESELLSCHAFT, and
BRASSERT OXYGEN TECHNIK AG.,
Petitioners,

v.

McLOUTH STEEL CORPORATION,
Respondent.

RESPONDENT'S BRIEF IN OPPOSITION TO PETITION FOR A WRIT OF CERTIORARI

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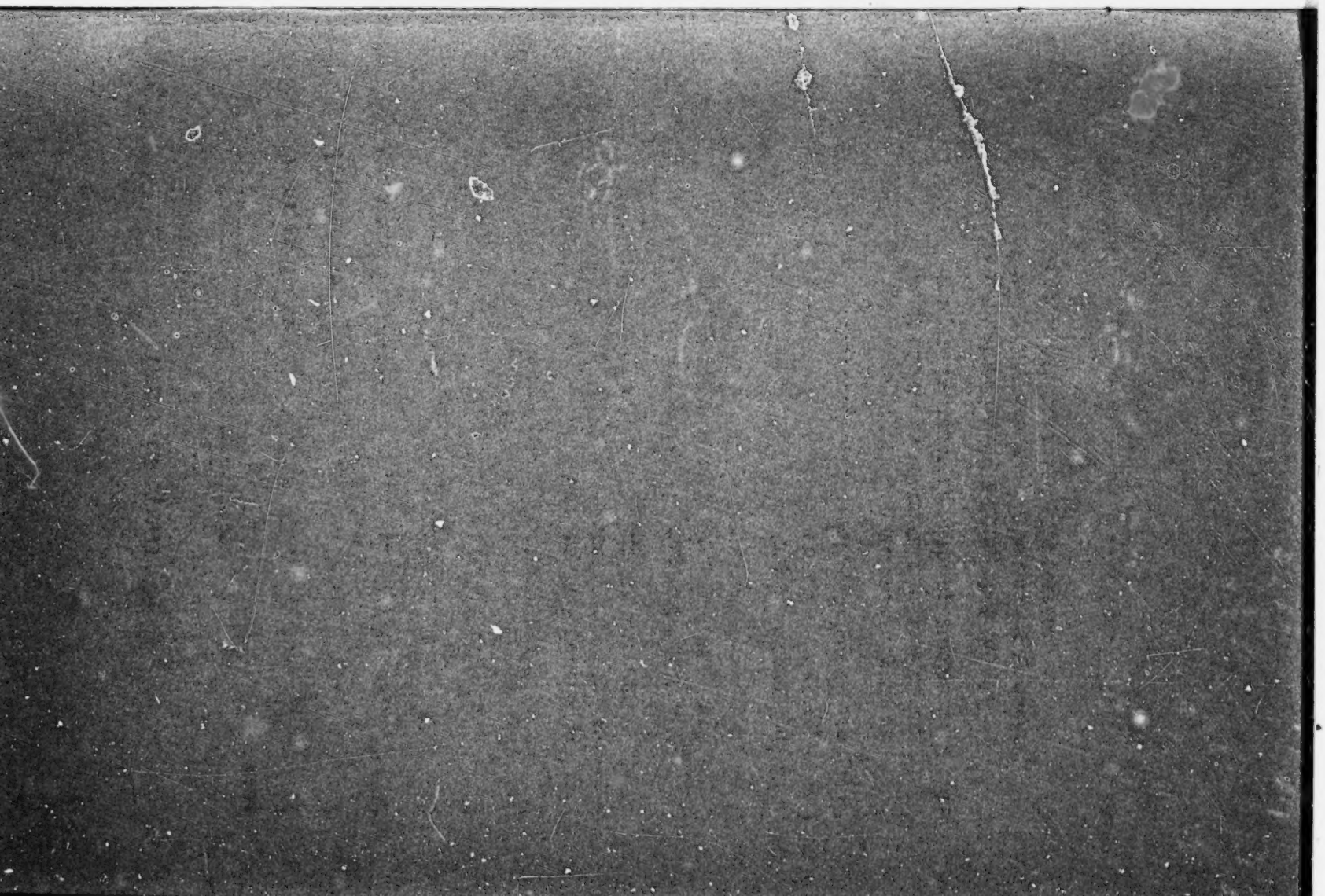

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IN THE

Supreme Court of the United States

October Term, 1968

No. 949

KAISER INDUSTRIES CORPORATION,
VEREINIGTE OESTERREICHISCHE EISEN-UND
STAHLWERKE AKTIENGESELLSCHAFT, and
BRASSERT OXYGEN TECHNIK AG.,
Petitioners,

v.

MCLOUTH STEEL CORPORATION,
Respondent.

RESPONDENT'S BRIEF IN OPPOSITION TO PETITION FOR A WRIT OF CERTIORARI

There is nothing about this ordinary patent case which warrants review by this Court.

The decisions of the District Court and of the Court of Appeals concurred in holding that the patent in suit, Suess No. 2,800,631, was invalid for two reasons: (a) because the claims did not comply with Section 112 of the Patent Act of 1952, and (b) because the claims attempted to extend their monopoly to something already patented. On both grounds, the evidence overwhelmingly supports these decisions.

The Petition does not and cannot rely on any of the reasons set forth in this Court's Rule 19: there is no conflict between decisions of Courts of Appeals; there is no question of public importance; there has been no departure from the accepted and usual course of judicial proceedings;

and there is no special or important reason why the Writ prayed for should be granted (*General Pictures Co.* v *Electric Co.*, 304 U. S. 175, 178-179 (1938)).

Opinions Below

The Opinion of the United States District Court for the Eastern District of Michigan is reported at 257 F. Supp. 372, and that of the Court of Appeals for the Sixth Circuit at 400 F. 2d 36. These opinions are printed in Petitioners' Appendix, respectively, at pages 45a through 204a, and 1a through 43a.*

Jurisdiction

The jurisdictional requisites are set forth in the Petition.

Questions Presented

Petitioners' statement of the questions presented—which is highly argumentative—might be more accurately and simply stated

> Where both lower courts concurred on the facts in holding that the claims of the patent in suit were invalid because they overclaimed the invention and because they covered the prior art, is there any reason which would justify the intervention of this Court?

Statute Involved

Section 112 of the Patent Act of 1952 (35 U. S. C. § 112) so far as pertinent, provides

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* For convenience, reference to either opinion will be to Petitioners' Appendix, cited "App. p. "; the transcript of the trial record will be referred to as "R. p. " and trial exhibits as "Px ", or "Dx "; italics and brackets within quotes are ours unless the contrary is noted.

"The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same . . .

"The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention".

Statement of the Case

It is necessary, at the threshold, to correct a misstatement made and repeated in the Petition, which, unless corrected, misleads.

The Petitioners, again and again, attempt to identify the process of the Suess patent in suit with the process of basic oxygen steelmaking and to represent the patent as covering that process. Thus, the Petition speaks of "a patent on what is concededly a revolutionary steelmaking process" (Pet. p. 7), or, ambiguously, of the patent, which "is addressed to the famous L-D or basic oxygen steelmaking process invented in Austria" (Pet. p. 3), or to the basic oxygen process "disclosed in the patent" (Pet. p. 9; see also pp. 15, 21, 22, 26).

The basic oxygen steelmaking process admittedly may be called "revolutionary", but the patent in suit does not cover that process. It came late upon the scene and was preceded by a host of patents, as is made entirely clear by the file histories of the two Suess applications, upon which the patent in suit issued (Px 2B and 2A).

The non-revolutionary character of the original Suess application is highlighted by the trifling nature of the advance claimed—a so-called ratio of bath depth to bath area (Px 2B, pp. 10-12). These claims "were four times

rejected by the Patent Office" (App. p. 54a), and, as noted by both Courts below, bore no relationship to the subject matter claimed in the patent in suit (App. pp. 26a, 54a).

The claims of the 1955 continuation-in-part application, like those of its predecessor, were again rejected (Px 2A, pp. 58-60). However, on June 11, 1957, an amendment was filed (Px 2A, pp. 72-95), cancelling all claims and bringing in two new claims, which with a single amendment, became the claims of the patent in suit. This June 11th amendment, completely changing the nature of the claimed invention, was heralded by the significant statement that "information recently made available", but coming six and a half years after the original application, indicated that the pending application disclosed "a fundamentally different approach . . . than was suggested heretofore" (Px 2A, p. 74; App. p. 215a). Six days later, a further amendment was made (Px 2A, pp. 96-97), and on June 27, 1957—sixteen days after the "different approach" amendment—the patent was allowed (Px 2A, p. 100).

The "different approach" claims, as allowed, were couched in language which conflicted with, or had no antecedent or support in the specification.

The holding of invalidity, in large part, is based on the unusual character of these claims. After the most painstaking analysis, the District Court concluded that

> "The claims of the patent in suit do not measure the invention of the applicants; they do not accurately define or correctly describe just what the applicants invented; they do not find adequate support in the specification; and they do not clearly distinguish what is claimed from what went before in the art. Therefore, the claims do not meet the requirements of 35 U. S. C. § 112, and the patent in suit must be held invalid. 35 U. S. C. § 282(3)" (App. p. 201a).

The Court of Appeals affirmed on these grounds (App. pp. 2a, 33a).

Reasons for Denying the Writ

1. The decisions below, holding that the claims of the patent are invalid because they fail to comply with § 112, are manifestly correct.

Section 112 requires that the claims of a patent shall "particularly [point] out and distinctly [claim] the subject matter" of the invention.

Two rules governing the application of this section are apposite. These are stated by this Court as follows:

First, in *United Carbon Co.* v. *Binney Co.*, 317 U. S. 228, 236-237 (1942), it was said

> "The statutory requirement of particularity and distinctness in claims is met only when they clearly distinguish what is claimed from what went before in the art and clearly circumscribe what is foreclosed from future enterprise . . . the claims must be reasonably clear-cut to enable courts to determine whether novelty and invention are genuine . . . Whether the vagueness of the claim has its source in the language employed or in the somewhat indeterminate character of the advance claimed to have been made in the art is not material. An invention must be capable of accurate definition, and it must be accurately defined, to be patentable".

So also *Gen. Electric Co.* v. *Wabash Co.*, 304 U. S. 364, 369 (1938); *Standard Brands* v. *Yeast Corp.*, 308 U. S. 34, 38, (1939).

And second, in *Schriber Co.* v. *Cleveland Trust Co.*, 305 U. S. 47, 57 (1938), it was held that the patent monopoly "cannot be enlarged by claims in the patent not supported by the description". So also *Permutit Co.* v. *Graver Corp.*, 284 U. S. 52, 57-60 (1931); *Stelos Co.* v. *Hosiery Corp.*, 295 U. S. 237, 241-242 (1935).

Three of the five steps of the claims* of the patent in suit directly violate Section 112.

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* Claim 1 of the patent is quoted verbatim on page 213a of Petitioners' Appendix. Claim 2 is dependent on Claim 1.

a. The step of avoiding "material agitation" has no antecedent in the specification and is meaningless.

The second step of the claims calls for jetting the oxygen "to an extent to avoid material agitation of the bath by the oxygen stream" (App. p. 213a).

The specification neither refers to "material agitation" nor to its avoidance.

Dr. Hauttmann, one of the patentees, admitted that

> "It doesn't state anywhere in the patent that [material agitation] should be avoided" (R. p. 2412).

And Petitioners' experts, Drs. Chipman and Elliott, admitted that they could find no teaching of it in the patent (R. pp. 880, 886-887, 6626, 6627).

In the light of these admissions, the District Court had no alternative than to find

> "The term 'material agitation' or 'avoidance of material agitation' is admittedly not used or defined in the specification of the patent in suit. (R. 13,326, 13,327, 13,328; also plaintiffs' main brief, p. 190; Dr. Chipman, R. 879; Dr. Elliott, R. 6627; Dr. Hauttmann, R. 2412.)" (App. p. 169a; see also p. 30a).

The District Court highlighted the basic lack of meaning of the term by quoting from the testimony of three of Petitioners' principal witnesses:

> "In addition, persons skilled in the art who testified for plaintiffs did not seem to know what the language of the claims referring to material agitation meant or to be able to tell when the conditions of such agitation or its avoidance would exist. For example, when Dr. Hauttmann, one of the patentees, was asked: 'How would an operator practicing oxygen blowing tell when the agitation produced by the jet became material?', he answered: 'I do not know that.' (R. 2414.) When Mr. Prince, a metallurgical engineer employed by plaintiff Kaiser, was asked: 'When does agitation become material?', he finally

> replied: 'I don't know, Mr. Groner. It is just when agitation becomes material.' (R. 5784.) Also, when Dr. Chipman was asked: 'You don't know from anything in the patent when a harmless agitation becomes a material agitation, do you, Doctor?', he replied: 'I don't think so.' (R. 880.)" (App. pp. 177a-178a).

The Court could not avoid its conclusion that this step

> "could not have been a meaningful concept to persons skilled in the art at the time the invention was made, especially since the concept did not appear very meaningful to some of plaintiffs' expert witnesses even at the trial roughly fourteen years later" (App. p. 178a; see also pp. 176a-179a).

The Court of Appeals found this ruling "amply supported by the evidence" (App. p. 30a).

Notwithstanding this, Petitioners now argue that the avoidance of "material agitation" "*must* mean avoidance of the 'agitation produced by deep penetration'" (Pet. p. 25, italics in original).

This is unsound because the patent in suit neither teaches nor suggests any identity or relationship between the terms "deep penetration" and "material agitation", and those skilled in the art had no knowledge of such a relationship.

The District Court, having analyzed in minute detail the evidence adduced by Petitioners in an attempt to show such a teaching by the patent (App. pp. 172a-174a), concluded:

> "Thus on close examination, none of the references [in the specification] relied on by plaintiffs teach any causal relation between deep penetration and material agitation by the oxygen stream" (App. p. 174a).

Not only does the patent fail to teach such a relationship, but the evidence in this case shows that there is no inherent relationship between "deep penetration" and "ma-

terial agitation", or the avoidance of either. Thus, Dr. Hauttmann admitted that he could not say whether the agitation of the melt increased and decreased as the penetration increased and decreased (R. p. 2418; see also p. 2414). And Petitioners' expert, Dr. Chipman, did not know whether deep penetration would cause agitation of the bath (R. pp. 949-951; see also App. p. 180a-181a).

Seemingly, Petitioners no longer rely on a direct teaching by the patent or on general knowledge in the art. Instead, they attempt to sustain an identity between the terms by reference to affidavits filed in the continuation application in June 1957—six and a half years after the original application was filed—by Drs. Rinesch (Px 2A, pp. 78-87) and Hauttmann (Px 2A, pp. 88-95). Petitioners' position is baldly stated:

> "The fact that the definition of the terms in the claims was contained in affidavits filed with the Patent Office rather than in the patent itself is of no significance" (Pet. p. 28, n.; see also pp. 24-28).

But the law is to the contrary, and Petitioners' only support for their argument is based on distorting (Pet. pp. 22-23; see also pp. 4, 7, 16-17, 19-28) the thoroughly established rule, most recently stated in *Graham* v. *John Deere Co.*, 383 U. S. 1, 33 (1966), that

> "an invention is construed not only in the light of the claims, but also with reference to the file wrapper or prosecution history in the Patent Office".

However, as the *Graham* case makes plain, the rule is applied to limit words to the meaning given them by the patentee in order to secure the allowance of the patent, and has never sanctioned grafting on to the patent something not included in its express terms.

Thus, Petitioners' argument finds no support in the *Graham* case, and it runs directly counter to the requirements of the pertinent statute and of the case law.

Section 112 requires, in the specification, a "written description of the invention," which is "full, clear, concise, and exact" enough "to enable any person skilled in the art . . . to make and use the same."

Giving effect to the statute (specifically to RS § 4888, the predecessor of Section 112), this Court in the *Schriber* case, *ante* p. 5, held

> "the patent monopoly does not extend beyond the invention described and explained as the statute requires, *Permutit Co.* v. *Graver Corporation, supra,* at 57; [and] . . . it cannot be enlarged by claims in the patent not supported by the description . . . " (305 U. S. 57).

To the same effect, the Court of Appeals for the Seventh Circuit, in *Universal Oil Products Co.* v. *Globe Oil & Refining Co.*, 137 F. 2d 3, 6 (1943), aff'd 322 U. S. 471 (1944), said

> "the meaning which the inventor gives to his words can not be made to depend upon subsequent events, but should appear when the application is filed".

See also the *Permutit* case (*ante* p. 5), 284 U. S. 56-60.

The decisions below were in full accord with the requirements of the statute and with the rule set forth in the *Schriber* case. The District Court held that persons skilled in the art of steelmaking

> "would, of course, not be responsible for knowing the contents of affidavits filed more than seven years later" (App. p. 177a).

The Court of Appeals, to the same effect, stated

> "The patent law does not require a prospective inventor to search so far in attempting to determine the scope of a patent and the areas left open for inventive inquiry . . . a prospective inventor is required to go no further [than the specification or knowledge

> attributable to one skilled in the art] in attempting to determine the invention claimed and the areas foreclosed to future enterprise" (App. p. 30a).

There is nothing to support the argument of Petitioners, which is based on a perversion of the rule of the *Graham* case.*

b. The step of jetting the oxygen "onto and below the surface of the bath" is contrary to the teaching of the specification.

Up to ten days before the allowance of the patent in suit the claims had called for jetting the oxygen "against the surface of a bath" (Px 2A, p. 72). On June 17, 1957, however, this was changed so that the step required jetting "onto *and below* the surface" (Px 2A, p. 96).

The earlier provision was in accord with the teaching of the patent. The later and final form is in direct conflict with the specification. Illustratively, the specification taught jetting vertically "upon the central portion of the surface of a bath" (App. p. 208a, col. 3, ll. 36-39), or "onto the surface" (*id.*, col. 3, ll. 52-53), or to "the central portion of the bath surface" (*id.*, col. 4, ll. 29-30, 71-72; see also p. 207a, col. 1, l. 23; col. 2, ll. 38, 46, 59, 63; p. 208a, col. 3, ll. 19-20, 49; col. 5, ll. 32-33, 61-62; p. 212a, col. 11, l. 41).

On the strength of these teachings the District Court held

> "At least thirteen separate references in the specification of the patent in suit speak of 'surface

---

* Going one step further, both the District Court and the Court of Appeals invoked a so-called file wrapper estoppel to give an *additional* reason for their conclusion that the avoidance of "material agitation" bore no relationship to the avoidance of "deep penetration" (App. pp. 164a-166a; 33a-43a). Since the conclusion that there is no relationship is overwhelmingly supported by the facts and the law, and is in no degree weakened or affected by disregarding the estoppel, it is not necessary to burden this Court with its consideration.

> blowing' or 'blowing onto the surface,' etc. But there is no reference anywhere in the specification to blowing 'below the surface,' as claimed. Col. 5, lines 61 and 62, speak of 'the confined zone of direct oxygen *reaction at the surface* of the molten metal bath,' (emphasis is added) which would seem to preclude a claim of blowing below the surface" (App. p. 193a, italics and parenthesis in original; see also pp. 193a-194a).

The Court of Appeals opinion does not discuss this failure of the patent to comply with the requirements of Section 112. However, its affirmance of the District Court apparently was intended to cover this (see App. pp. 2a-3a, 7a).

The teaching of the patent is perfectly understandable: that teaching is opposed to the first step of the claims. The District Court, under the circumstances, made the only possible holding, and that holding perfectly accords with the rule of the *Schriber* and *Permutit* cases (*ante* p. 5).

c. The step of producing a circulatory movement caused by chemical reactions is contrary to the teaching of the specification.

The fifth step of the claims, calling for the production of a circulatory movement in the bath caused by "said reaction", that is, the chemical reaction between the oxygen and the iron and the iron impurities, also made its initial appearance in the amendment of June 11, 1957. But, in opposition to this, the specification teaches that circulation is the result of the physical force of the jet (App. p. 208a, col. 4, ll. 28-34), and it teaches a different function for the chemical reaction to which the claims refer. Specifically, the specification teaches that the reaction between carbon (one of the iron impurities) and FeO and oxygen, with the formation of CO "causes a strong boil or agitation of the bath" (App. p. 208a, col. 4, ll. 60-67).

The District Court analyzed the pertinent parts of the patent on a line by line basis (App. pp. 187a-189a; see also pp. 190a-193a) and held

> "The claim of a circulatory movement in the molten metal produced by chemical reactions in a localized reaction zone is simply not supported by the teachings of the specification of the patent in suit. References relied on by plaintiffs in this connection do not teach a circulation induced by chemical reactions" (App. p. 187a).

Again, the holding is that impelled by the *Schriber* and *Permutit* cases.

2. The decisions below, holding that the claims of the patent are invalid because they cover the prior art, are manifestly correct.

The District Court considered in detail each step of the claims in the light of what the prior art taught, relying, in large measure, on the testimony of Petitioners' witnesses, and, particularly, on that of Petitioners' chief expert, Dr. Chipman (App. pp. 194a-198a). In the light of that analysis, the Court noted that "the distinction" between the claims and the art "may well be a purely verbal one". The Court further noted that Petitioners had had "considerable opportunity", both before and during trial, to demonstrate, by experiments, that distinctions existed, but that Petitioners "admittedly failed" to produce any such evidence (App. p. 198a).

The Court concluded

> "At trial, certain of plaintiffs' witnesses candidly interpreted the claims of the patent in suit as being so broad that any commercial steelmaking operation involving vertical blowing would necessarily infringe even if the operation were following prior art teachings, although the language of the new claims was clearly intended to distinguish the prior art patents. Such claims, if allowed, would flout the patent law of the United States" (App. p. 199a).

The Court of Appeals, in affirming, made a generally corresponding comparison (App. pp. 21a-31a).

The soundness of these holdings is demonstrated briefly by uncontested fact.

Dr. Trenkler, one of the patentees, admitted, in the words of the District Court,

> "that the only significant difference in practice over prior teachings was a reduction of the impact pressure of the jet and, therefore, a lesser penetration into the bath by the jet than would have resulted from prior teachings (R. 11, 905.)" (App. p. 101a).

Indeed, as the District Court found, this is the position of Petitioners (App. pp. 160a-161a; see also p. 126a). The Court of Appeals epitomized the situation in these words

> "In sum, the only difference between the Suess disclosure and the prior art is the teaching of avoidance of deep penetration as opposed to deep penetration" (App. p. 21a).

Despite having narrowed the issue to the single question as to the type of penetration which had to be avoided, Petitioners, with utter inconsistency, attempted to stretch the patent to cover Respondent's operation.

The result, as the Court of Appeals found, is that

> "the patentees now seek a broader description of that term encompassing any penetration of one half the bath depth or less" (App. p. 27a).

The District Court's summarization of the testimony of Petitioners' witnesses abundantly supports this conclusion (App. pp. 106a-107a).

But, in stretching the patent, Petitioners simply went from Scylla to Charybdis, and wound up with the patent squarely within the teachings of the prior art Schwarz patent. Schwarz taught that the reactions took place "in the center of the steel bath" (App. p. 234a, ll. 23-24), or, as Dr. Hauttmann expressed it, at "the middle of the melt" (R. p. 2525; see also Dx 15, p. 30).

The patent, therefore, makes no advance over Schwarz, and is invalid. The Court of Appeals understated the situation when it said

> "when it is once admitted that the oxygen jet penetrates into the bath to any not insubstantial degree, it becomes almost impossible to distinguish 'deep penetration' as taught by Schwarz and Miles from 'avoidance of deep penetration' as taught by the patentees" (App. p. 25a).

Conclusion

The Petition should be denied

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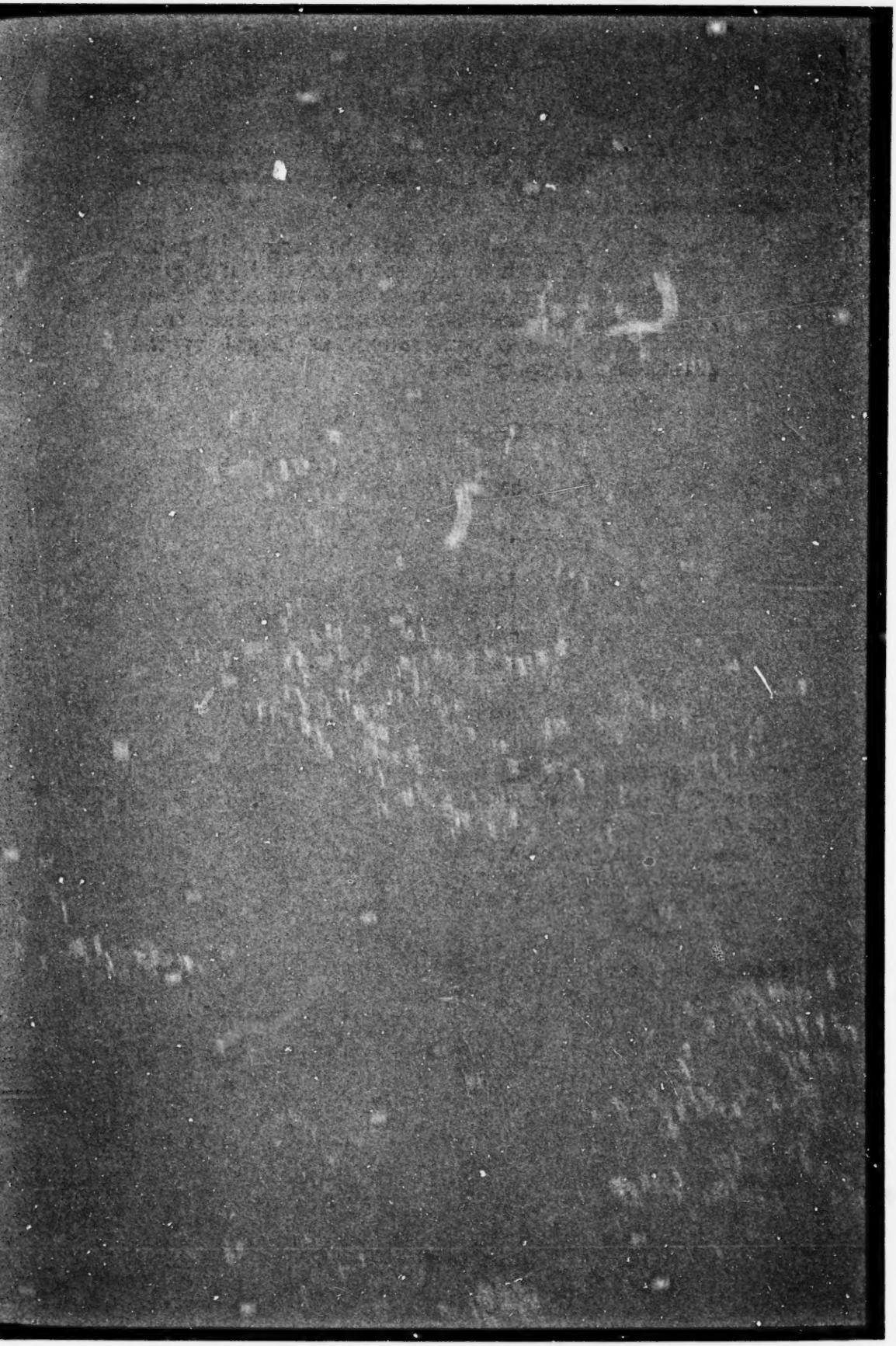

SUPREME COURT, U. S.

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IN THE

Supreme Court of the United States

October Term, 1968

No. 949

KAISER INDUSTRIES CORPORATION,
VEREINIGTE OESTERREICHISCHE EISEN-UND
STAHLWERKE AKTIENGESELLSCHAFT, and
BRASSERT OXYGEN TECHNIK AG.,
Petitioners,

v.

McLOUTH STEEL CORPORATION,
Respondent.

BRIEF OPPOSING MOTION OF THE GOVERNMENT OF AUSTRIA FOR LEAVE TO FILE A BRIEF, *AMICUS CURIAE*

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Respondent.

BRIEF OPPOSING MOTION OF THE GOVERNMENT OF AUSTRIA FOR LEAVE TO FILE A BRIEF, *AMICUS CURIAE*

The Government of Austria has moved for leave to file a brief, as *amicus curiae,* in support of the Petition for a Writ of Certiorari filed herein on January 16, 1969 by the Petitioners, Kaiser Industries Corporation, *et al.* The brief, itself, is attached to and follows the Motion.*

The Motion is without legal or factual basis or justification. The Brief is simply a restatement of the arguments made in the Petition.

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* References here will be designated as in Respondent's Brief in Opposition (see Br. in Op. p. 2). Additionally, the Petition for the Writ of Certiorari will be referred to as "Pet. p. "; the Motion of the Government of Austria as "Mot. p. "; and the Brief attached to the Motion as "Mot. Br. p. ".

1. The Motion is Without Valid Basis.

The Motion does not comply with the provisions of this Court's Rule 42, and, particularly with the requirement that it "set forth facts or questions of law that have not been, or reasons for believing that they will not adequately be, presented by the parties . . ." (Rule 42-3).

While the Motion does assert that the "interests" of Austria "cannot be adequately presented by the parties" (Mot. p. 3), it makes no attempt to support this statement —and it is self-evident (see paragraph (a), below) that had Austria, at any time in the last ten years, felt its "interests" were not "adequately presented", it could have taken the necessary corrective action. The situation here is not unlike that in *Northern Securities Co.* v. *United States,* 191 U. S. 555, 556 (1903), where leave to file a brief *amicus curiae* was denied.

Beyond this

(a) Austria, in no sense, is an *amicus curiae;* it is an interested party owning one of the Petitioners, Vereinigte Oesterreichische Eisen-Und Stahlwerke Aktiengesellschaft (VOEST) (Pet. p. 8; see also Mot. p. 2), which, in turn, owns all of the stock of a second Petitioner, Brassert Oxygen Technik AG. (BOT) (R. pp. 9381-9382). A stockholder does not qualify as an *amicus curiae.*

(b) The Motion says that Austria's participation is

> "appropriate because the decisions below give rise to domestic and foreign policy problems for Austria" (Mot. p. 2; see also p. 3).

The "domestic and foreign policy problems" of Austria have no proper place in this litigation, and the Motion, in attempting to inject such problems here, is an impertinent effort to interfere with the normal course of judicial proceedings in the United States.

(c) The Motion states that

> "Steelmakers of nations throughout the world have paid royalties for the use of the invention in question [assumedly that of the patent in suit] . . . Only in the United States has the basic patent for the revolutionary L-D steelmaking process even been challenged" (Mot. p. 3).

This unsupported statement is contrary to the facts.

First, "steelmakers of nations throughout the world" have taken licenses under the VOEST-BOT international pool of patents, but not under "the invention in question". In 1956 there were over 300 patents in this pool (Dx 15, p. 65) and at the end of 1961 over 700 patents and 299 applications in 38 countries (Dx 83A). But, in many of these countries there was no Suess patent (Px 342, par. H; Px 15B; Px 17B, Px 24B; Px 26B; Px 27B and D), and, in the countries where a Suess patent said to correspond to the patent in suit existed, not a single one was directed to the subject matter here involved (Dx 69).

Even more significantly, the record here does not show a case, in the United States or elsewhere, where a license was sought or granted under the patent in suit or under a process defined in the language of the specification or of the claims of the patent in suit.

Second, the patent in suit is *not* "the basic patent for the revolutionary L-D steelmaking process".* It was preceded by a host of patents relating to the basic oxygen steelmaking process**, including particularly Schwarz German No. 735,196 of 1943 (App. pp. 231a-235a), and Miles Belgian No. 468,316 of 1946 (App. pp. 236a-254a), both of which were owned by VOEST-BOT (App. pp. 13a-14a).

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* It is assumed that the expression "L-D steelmaking process" refers to the process generally called the basic (as contradistinguished from acidic) oxygen steelmaking process (see Pet. p. 3).

** The file histories of the two Suess applications show 11 prior art references (Px 2B and 2A), and seven additional references were set up by the defendant (Defendant's Substitute Answer, etc.).

The history of the origin and evolution of the patent in suit makes it abundantly plain that there is nothing basic about it.

The patent issued on a continuation-in-part application filed in November 1955 and based on an original application filed in 1951 (Px 2A and 2B). The original application aimed only at the unimportant and unused idea of maintaining a ratio between the bath depth and its surface area (Px 2B, pp. 2, 9-12). No claims of this type were allowed by the Patent Office (Px 2B, pp. 15-16, 20-21, 30-32, 39-40), and other claims aimed at different subject matter then were introduced (Px 2B, pp. 43-45, Px 2A, pp. 31-33), but with no greater success (Px 2B, p. 48, Px 2A, pp. 58-60). Finally, claims of a third type were brought forward (Px 2A, pp. 72-95), and became those now in suit.

That the patent in suit is in no way "basic" is shown not only by its history, but by the earlier claim of VOEST and BOT that their Schwarz patent was basic.* Specifically, they said it represented "a fundamentally new idea", which

> "for the first time points out a method by which, in practical operation, steelmaking iron can be refined by direct reaction with pure oxygen" (Dx 5, pp. 3, 27-28).

The Motion of the Government of Austria is without merit and should be denied.

2. The Brief Attached to the Motion Sets Forth No Valid Reason for the Grant of the Writ of Certiorari.

The Brief attached to the Motion offers nothing new and is simply a reworded edition of the Petition for Certiorari (compare Mot. Br. pp. 10-24, with Pet. pp. 21-28, and Mot. Br. pp. 24-27 with Pet. pp. 29-31).

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* This was in 1953, three years after the first Suess application was filed in Austria, and two years after the original Suess United States application (App. p. 54a).

It is characterized by the unjustified breadth of its statements, and by the fact that few of its statements make any pretense of being supported by the record.

The facts and the law urged in opposition to the grant of the petition (see Br. in Op. pp. 5-14) have equal application here and need not be repeated. It is sufficient to briefly note several statements of the Brief to which exception must be taken.

1. The Brief inveighs against the decisions below, saying that

> "The result was a mechanical, insensitive, and unjustifiably harsh application of the statute [§ 112]" (Mot. Br. pp. 23-24),

and that

> "The grounds for invalidity were trivial compared with the consequences" (Mot. Br. p. 2).

Again and again the Brief refers to "technical drafting errors" (Mot. Br. p. 3), and to "insignificant and unnecessary technicalities" (Mot. Br. p. 9; see also pp. 4, 5, 16), as though the only fault in the patent in suit was an error in drafting.

This is far from the fact. The District Court noted and excused many errors in the specification of the patent which were more serious than drafting errors (App. pp. 147a-158a). Beyond this, however, the specification abounds in indefinite and indeterminate terms, such as, avoiding "*deep* penetration" (App. p. 208a, col. 3, ll. 46, 74; col. 4, l. 70; p. 211a, col. 9, l. 18), a "*relatively confined* zone" (App. p. 208a, col. 3, ll. 47-48; p. 209a, col. 5, l. 61), and a "*localized* center" (App. p. 208a, col. 4, l. 35), and the steps of the claims, in some cases meaningless, suffer either from having no antecedent in (step 2), or from actual conflict with (steps 1 and 5) the specification (Br. in Op. pp. 6-12).

Literally, it is impossible, by study of the patent, to define its process or determine what is covered by its claims.

And it is for the purpose of guarding against this that Section 112 exists. It is not a new section, but is based on and substantively follows 35 U. S. C. § 33 (1946 Ed.), which, in turn, was based on R. S. § 4888, which goes back to the Act of July 7, 1870 (see Act of July 7, 1870, c. 230, § 26, 16 Stat. 201; amended March 3, 1915, c. 94, § 1, 38 Stat. 958; May 23, 1930, c. 312, § 2, 46 Stat. 376).

Moreover, the broad public purpose which is the heart of Section 112 (and of its predecessor statutes), has many times been referred to by this Court.

Thus, in *Gen. Electric Co.* v. *Wabash Co.*, 304 U. S. 364 (1938), it was said that

> "The limits of a patent must be known for the protection of the patentee, the encouragement of the inventive genius of others and the assurance that the subject of the patent will be dedicated ultimately to the public. The statute seeks to guard against unreasonable advantages to the patentee and disadvantages to others arising from uncertainty as to their rights" (304 U. S. 369).

Again, in *United Carbon Co.* v. *Binney Co.*, 317 U. S. 228 (1942), this Court said that

> "To sustain claims so indefinite as not to give the notice required by the statute would be in direct contravention of the public interest which Congress therein recognized and sought to protect" (317 U. S. 233).

And, in *Universal Oil Co.* v. *Globe Co.*, 322 U. S. 471 (1944), this Court said

> "But the *quid pro quo* [for the grant of the patent] is disclosure of a process or device in sufficient detail to enable one skilled in the art to practice the invention once the period of the monopoly has expired; and the same precision of disclosure is likewise essential to warn the industry concerned of the precise scope of the monopoly asserted . . .
>
> "The claim is required to be specific for the very purpose of protecting the public against extension of the scope of the patent" (322 U. S. 484-485).

So also *Gill* v. *Wells*, 22 Wall. 1, 25-26 (1874); *Halliburton Co.* v. *Walker*, 329 U. S. 1, 10 (1946).

2. The Brief attempts to equate "the avoidance of deep penetration" and "the avoidance of material agitation". In that connection, it criticizes the Court of Appeals for holding (App. p. 30a) that the term "avoidance of material agitation" was "meaningless". The Brief goes on to say that when the patent was applied for (assumedly in 1951, when the first United States application was filed),

> "the term meant something to those skilled in the art, to the patentees, and to the Patent Office" (Mot. Br. p. 12).

The statement, unsupported by any record citation, is contrary to the fact. As has been shown, neither the patentees nor those skilled in the art knew what the "avoidance of material agitation" meant (Br. in Op. pp. 6-7).

With respect to the terms "avoiding deep penetration" and "avoiding material agitation", the Brief states that

> "So far as the patentees were concerned, the phrases were synonymous" (Mot. Br. p. 11).

But there is nothing in this record to show that that is so, and one of the patentees, Dr. Hauttmann, testified that he did not associate agitation with penetration (R. p. 2414), and could not say whether agitation increased and decreased as penetration increased and decreased (R. p. 2418).

The fact is that the term "avoidance of deep penetration" is as meaningless as the "avoidance of material agitation". Illustratively, Petitioners' chief expert, Dr. Chipman, said

> " 'deep' does not always mean the same thing to me. I regard such a word as 'deep' as requiring a further definition" (R. p. 715).

And, on this trial Petitioners' witnesses—all brought forward as experts—said that a penetration ranging from 35% to "90% to 100%" of the bath depth was allowable

within the teaching that "deep penetration" was to be avoided (App. pp. 106a-107a). The District Court could only hold that the term "avoidance of deep penetration" had "no precise meaning" (App. p. 101a).

This is so basically true that it has lent itself to any meaning opportunism suggested.

Thus, when the patentees desired to avoid the prior art they maintained that the avoidance of "deep penetration" meant no penetration at all, but when they wished to bring Respondent's operation within the terms of the patent, they redefined the term as allowing a penetration up to one half the bath depth.

Substantiating this statement, when the applicants, both in the United States and in Germany, were confronted with the prior art Schwarz and Miles patents, they, in the words of the District Court,

> "defined the avoidance of deep penetration as practically no penetration at all in order to distinguish the prior art for purposes of prosecuting their own patent applications" (App. p. 105a).

The Court of Appeals reached the same conclusion (App. p. 27a), and both Courts did this only after a detailed review of the actual representations made by the applicants to the German and American patent offices (App. pp. 103a-105a, 25a-27a).

This litigation made it expedient to redefine the term, since the McLouth operation involved a penetration to or beyond the middle of the bath (R. pp. 10972, 10995, 11017, 6748, 6756, 8778). To take care of this situation, again in the words of the District Court:

> "Dr. Hauttmann testified that the process of the patent in suit involved a penetration of not more than one-half of the bath depth. (R. 2530.) Dr. Trenkler testified that penetration from one-third to one-half of the bath depth would be the maximum penetration under the teachings of the patent in suit. (R. 11,911.)" (App. pp. 106a-107a).

The Court of Appeals, quoting the same testimony, noted that

> "the patentees now seek a broader description of that term [than no penetration] encompassing any penetration of one half the bath depth or less" (App. p. 27a).

3. The Brief makes the unsupported statement

> "As soon as high purity oxygen became available at low cost and in large quantities, many workers tried to use it in various ways to refine iron into steel. None, however, knew how to do it and their efforts failed" (Mot. Br. p. 6).

The facts are to the contrary.

The Miles patent, owned by VOEST-BOT, speaking as of November 1946, said that oxygen

> "has never been applied on a large scale [in steelmaking] due to the relatively high cost of pure oxygen" (App. p. 239a).

Dr. Chipman placed the date of the availability of bulk oxygen in 1947 (R. pp. 9414-9415), and Dr. Trenkler stated that

> "European firms were now [in 1949] also able to produce inexpensive oxygen" (R. pp. 11923-11924).

Others in Petitioners' camp made similar statements (Dx 61, Robiette article, p. 1103; Dx 68, patent No. 2,644,746, col. 1, ll. 1-7 and patent No. 2,829,960, col. 1, ll. 25-28).

While the District Court refused "to fix with certainty" a date for the inexpensive availability of bulk oxygen (App. p. 97a), it did hold that

> "In the 1940's, especially after World War II, pure oxygen apparently became more readily available at low cost, and experimentation with oxygen in steelmaking increased in intensity" (App. p. 51a).

Even more to the point, the Court of Appeals held that

> "Prior to 1950 not a great deal had been done commercially with the use of pure oxygen in the refining process" (App. p. 11a).

And, after high purity oxygen became available, this record contains no evidence of the failure of any "worker" who "tried to use it in various ways to refine iron into steel".

To the contrary, in 1951, Dr. Trenkler wrote the VOEST general manager that

> "Attempts to produce steel *with pure oxygen* in the converter had been made with good success in 1948 at Gerlafingen [by Drs. Durrer and Hellbruegge]" (Dx 31B, p. 3, italics in original).

And, in 1953, VOEST published an article by Dr. Hauttmann admitting that in 1948

> "R. Durrer and H. Hellbruegge had been successful in producing a steel of satisfactory quality by blowing an inclined jet of pure oxygen onto a bath of pig iron in a two-ton tilting vessel" (Dx 15, p. 29).

To the same effect is the VOEST-BOT representation, already noted, that the 1943 Schwarz patent

> "points out a method by which, in practical operation, steelmaking iron can be refined by direct reaction with pure oxygen" (*ante* p. 4).

Conclusion

The Government of Austria fails in its Motion to show a single, valid reason why that Motion should be granted, and the attached Brief—simply another statement of the arguments made in the Petition—emphasizes that the Motion is unfounded and without merit.

The Motion should be denied.

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v.

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PETITIONERS' REPLY TO BRIEF FOR RESPONDENT IN OPPOSITION TO THE PETITION

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PETITIONERS' REPLY TO BRIEF FOR RESPONDENT IN OPPOSITION TO THE PETITION

Respondent's brief neither denies nor traverses effectively the reasons advanced by petitioners as to why this Court should grant the Petition. In reality, it emphasizes the fact that the decisions below are in conflict with prior decisions of this Court and various Courts of Appeals.

I.

Respondent's assertion (Br. 3-4) that the process of the Suess et al. patent is not the basic oxygen steelmaking process is obviously incorrect in view of the findings of the District Court set forth at pages 9, 10 and 18 of the Petition. The District Court found that

the specification teaches this revolutionary basic oxygen process, that it was patentable and that it is used at Linz, by defendant and by others throughout the world (App. A, pp. 46a, 62a, 68a, 158a, 202a).

The only bases for respondent's statement and for the assertion in its restated question that concurring opinions below held that the *claims* "covered the prior art" are the misconstruction of the claims resulting from the refusal of respondent and the Courts below to look to the file wrapper history to construe the claims and the erroneous application of the doctrine of file wrapper estoppel. This misconstruction is the basic question presented. Thus, respondent's assertions beg the question.

II.

Respondent does not even attempt to support the erroneous interpretation and application of the file wrapper estoppel doctrine used by the courts below to defeat the patent in suit (Question 2).* Respondent neither denies nor rebuts petitioners' arguments demonstrating the total inapplicability of that doctrine, which was so heavily relied upon by the District Court (App. A, pp. 164a-167a, 175a).

III.

Respondent admits that, under this Court's decisions, an invention is to be construed "with reference to the file wrapper or prosecution history in the Patent Office" (*Graham* case) "to limit words to the meaning given them by the patentee in order to secure the allow-

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*Respondent's position here is consistent with its earlier actions. It neither pleaded file wrapper estoppel nor argued it in either of the courts below.

ance of the patent" (Br. 8). This is exactly what the courts below *expressly refused* to do, and is the error to which Question 1 is directed. The lower courts refused to "limit" the words used to the meaning *which the District Court expressly held was given to them in the file history* (App. 104a, 109a, 175a). Respondent does not challenge the District Court's holding that the file wrapper makes the words used clear and definite. It argues only that the file wrapper history cannot be used to clarify the meaning of those words. But, if, as the lower courts have held and respondent argues (Br., pp. 12-14), the claims when read *in vacuo*, i.e., without guidance of the file wrapper history, (1) include a "meaningless" term and (2) thereby overclaim the invention, but when read in light of the file history are (a) clear and definite and (b) limited to the "real gist of the invention," then the file history must be used to limit the words to the meaning given them by the patentees. The *Graham* case requires such a construction.

Thus, if we take respondent's admission and this holding of the District Court, it follows that the decisions below are in direct conflict with the *Graham* case and other decisions of this Court.

The only reason given by respondent and the lower courts for their *refusal* to refer to the file history is that someone interpreting a patent claim should not be required to go further than the specification and the knowledge of those skilled in the art to determine the meaning of the claim. The courts below gave no reason why a person interpreting a patent should not be required to review the file history. It is, in fact, the general practice of all those interpreting a claim of a patent to refer to the file history.

Respondent (and also the District Court) further suggests that, since the affidavits were not filed until seven years after the original application was filed, they should not be considered. However, the affidavits and the amendment, which petitioners assert should be considered, were filed *at the same time* that the claim language sought to be clarified was first used. Obviously, the meaning of specific words need not be and cannot be explained until they are used. Also, claims are not considered or interpreted by third parties until the patent issues, at which time the file history becomes available to all.

IV.

Respondent's detailed arguments on lack of support for the claims in the specification, overclaiming and covering the prior art beg or evade the real question presented (Question 1), *i.e.*, the proper legal standards to apply in construing the claims. If the proper standards are applied and the claims properly construed in the light of the file wrapper history (particularly the Hauttmann affidavit) and the specification, the alleged overclaiming, covering of the prior art and lack of support completely disappear.*

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*Respondent, in its briefs in response to the Petition and the Amicus brief, has made many incorrect, incomplete and misleading statements as to both the evidence and the holdings below. However, we will not reply to them herein because they are irrelevant and immaterial as to the issues presented by the Petition.

V.

The decisions below should not be allowed to stand. The legal issues and policy considerations presented are of great importance and should be settled by this Court; and the grossly inequitable result reached by the courts below should be erased.

Respectfully submitted,

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